Heating and Ventilating

For Engineers and Contractors Controlling the Design, Specification, Installation and Maintenance of Heating, Ventilating and Air Conditioning

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"Devices for accomplishing the cleaning, dehumidifying and cooling of air, as well as heating and moistening, are well worth investigating since they all promote health, comfort, and efficient work."

Air Conditioning for Small Buildings

What It's All About

IN line with our long time policy of keeping you informed of developments as they come along, HEATING AND VENTILATING has been watching the extension of comfort conditioning to smaller volume units for some time, kept in touch with events, and has collected material for use when the time came. We now take pleasure in offering this summary of the equipment situation.

Our decision that now is the time to summarize is based on the receipt of an increasing number of inquiries during recent months from readers who frankly state that they are confused both by the rush of new products to the market and the difficulty of picking out their performance characteristics in the midst of the hullabaloo over air conditioning in the general press.

It is not surprising that there is confusion in view of the general disagreement over how the words air conditioning should be used and the weird and sometimes fantastic interpretations put on them by people who obviously are just barely on speaking terms with the whole idea.

For some time we considered what ground we should cover to make the issue of most benefit to those who inquired and to our readers in general. At first we thought some of the phases having to do with performance would be most useful and that a discussion of equipment types should be secondary. On further thought, though, it seemed evident that a full but brief description of the equipment available for accomplishing the job would not only give a key to performance but that the description itself would serve to bring out some of the elements which are causing confusion. Moreover, it would make available a list of products and their makers from whom further information can be secured. As a result we prepared the equipment section, pages 41-66.

The question of what constitutes small buildings and small building methods was troublesome, for while some types of the equipment useful in small building work cannot well be used for large ones, other types can very well find use in either by using multiple units. In order to present the equipment in a fair and just light it seemed necessary to include the chief classes which reasonably can be used on small jobs—in small units of space to be conditioned—whether these spaces are contained in a larger building or are detached by themselves. Much of the equipment described is thus useful in detached residences, apartments, hotel rooms, offices, restaurants, retail stores, and like places where the unit of space is relatively small. We do not include the equipments so widely used in "central" methods, such as large factory or theater spaces. Neither do we consider in full many of the small, portable units.

This decision to make equipment rather than methods or performance the feature of the issue was also influenced by another set of facts. It takes no extended thought to conclude that as we try to apply air conditioning to smaller and smaller units of space using smaller and smaller plants, the more difficult it is to keep unit costs down, for many of the elements entering into the plant become more costly per unit as the size decreases. This can be overcome by either better and cheaper methods of production, distribution and installation or else by the development of wholly new and cheaper methods of accomplishing air conditioning. At present some promising attempts are being made to accomplish the latter, but we are not considering them now. Instead, the whole burden has been laid on cheaper production, distribution and installation methods.

The easiest and obvious solution to cheaper production has been the application of factory methods and to attempt to develop designs which will permit sending units to the site as fully assembled as possible. This plan also helps to keep down installation costs, for erection on the site is reduced to a minimum. It also helps to lessen the charge against engineering as the field engineering is simplified and tends to become standardized.

The result of all this has been that the use of air conditioning in small plants has become almost entirely a matter of placing factory-built and assembled units on the job. In fact, it may be stated that the matter of a reasonable price is so important that at present no large number of such installations could be made if we did not have available production-built units to compete with the production-built unit used in the older heating installations in similar buildings. Small plants do not permit of the use of made-to-measure installations. All this makes the equipment units the important and critical parts of the plants and made it more desirable that we feature the equipment side of the subject.

Another consideration is the relative newness of these units. Our records show that by far the majority of

them have been announced in their present form within the past two years. A large number have appeared during the past 12 months. Many of our readers are not familiar with them, as installations are not yet common.

When we started to gather the equipment information the expected difficulty resulting from the use of the words "air conditioning" in so many entirely different ways had to be overcome. In many ways it is too bad that with a language as expressive as English we haven't found words to replace them. The indiscriminate use of the words is really at the root of much of the confused thinking. We found it necessary to analyze the equipment by function in order to have it mean anything.

Several suggestions for adequate and reasonable naming have been made, but as they have made little headway in use, we are disregarding them. Instead we offer the suggestion that for immediate purposes it is better to classify the equipment by the use of our own familiar words and to treat it by the groups with which we are already familiar. We have consequently classed the equipment in what may be considered the heating man's way. We believe that this will help to clear up the confusion resulting from calling all kinds of equipments by the blanket term—"air conditioning."

We believe that the confusion and mystery surrounding air conditioning for small buildings is holding back progress in that many engineers and contractors refuse to recommend it solely because they are themselves misled into thinking that it is something complicated. As applied to small buildings, with little if any moisture pick-up in summer and with factory-built equipment, the whole idea and the processes themselves are ridiculously simple in principle and are easily grasped if the underbrush of confusion of terms can be cleared away. To help in this we have included some sketches which show the relation between simple winter heating plants and the more recent innovations. Looked at in this way the year-round plant will be seen to be not greatly different from the heating plant.

Following the equipment section we have prepared a summary statement which should prove especially interesting as it shows the number of standard units of each type available and gives their principal characteristics.

Data resulting from operation are just beginning to appear. Summer cooling is so new that we have no reliable guide to go by either in operating the plants after they are installed or in making estimates preceding construction. We have had to rely on the little information available from laboratory studies. We include some information resulting from a record kept showing the reactions of customers to air cooling in storerooms in Detroit. We believe that information of this kind is valuable and essential and that it should be made available to all.

Conditioning Units— As a Heating Man Would Group Them

SINCE standard production equipment is so important in small and medium-sized building installations, we began classifying this equipment. To be valuable to the heating man we felt that a classification must not only be reasonably logical and complete, but that it ought to be set up in his own language. In looking about for a suitable basis we found several difficulties.

First of all, instead of sticking to the descriptive words such as "direct," "indirect," which are well known to all of us, there seems to be a tendency to use many new terms. We fail to see any reason for this except that some words common to refrigeration practice are finding their way into the descriptions of the apparatus. We believe that the man who is familiar with heating apparatus and who starts going into air conditioning work will do much better to use his own long familiar words so far as possible. Consequently, we decided to build up our classification of types by using the old words "direct," "indirect," "central," and "unit" so far as possible.

In the second place there is still a great deal of confusion surrounding the use of the words "air conditioning." We have often called attention to this and have felt that it would lead to difficulties. When one starts going over the equipments now available this confusion of terms is very marked. The whole subject is changing rapidly and there is no agreed-upon system of naming. Again, from the standpoint of the heating man, we believe that it is best to forget about the words "air conditioning" and to start in again with our familiar terms and build from there.

Simply stated, about all we can do to the air is to heat and add moisture to it in winter, to cool and take moisture away from it in summer, and to clean and circulate it the year round. This gives rise to the following listing which every heating man will find a help in keeping his thinking straight:

Year-round functions—cleaning and circulating
Summer functions—cooling and dehumidifying
Winter functions—heating and humidifying

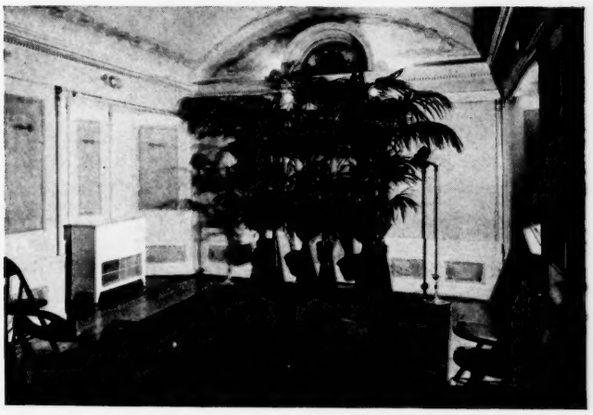
It will also help in clear thinking to keep in mind all the time that, regardless of details, the application of the magic words "air conditioning" to our well-established winter methods adds nothing and takes away nothing from what we have been doing fundamentally for years. All that the newly-available equipments do is to add refinements of method. We have always heated the air in winter and have circulated, humidified and cleaned it to some extent. The newer equipments

A Kansas City radio broadcasting studio cooled by a ChilAire portable iced room cooler.

A Frigidaire cooling unit takes care of the heavy heat load from the various beautifying treatments in a hair-dressing establishment.

Cooling for Profit

A Copeland cooling unit shown in the rear of a Mary Lee candy shop and soda fountain, Detroit.



Mortuaries are good prospects for cooling units, such as the IIg cabinet type shown above.

The tiresome task of selecting millinery is made easier in this store by a Carrier-York atmospheric cabinet.

place more stress on the desirability of *thorough* cleaning, *adequate* humidifying and *positive* circulation in winter.

In addition to these changes in the winter functions the new equipments make use of the ideas of summer operation of fans and cleaners and the treatment of the air throughout the year. It is in this that they differ most from our traditional ideas. Perhaps this is the reason that some people think of "air conditioning" as cooling, and will insist that it isn't air conditioning unless cooling in summer is accomplished. Fundamentally this is an erroneous idea and the industry as a whole is showing plain signs of refusing to accept it.

In setting up our classification, therefore, we determined to disregard the words "air conditioning" altogether and to describe and classify the equipment types on the basis of what they do.

Closely related to the confusion of names, and a real difficulty in classifying present equipment, is the fact that there is a tendency to look on the summer functions as entirely apart from the winter functions. Some equipments aim only at obtaining satisfactory results during the winter months, while others aim only at summer results. We have no criticism to offer regarding this for we realize very well that it is a necessary condition, especially under present circumstances. It does, however, add to the confusion when one tries to get a broad gauge view. In arranging our classification and in treating the whole subject we feel that the provision of satisfactory air conditions should be regarded as a unified proposition, and that the plants for obtaining them should be looked on as units if the whole field is to be visualized. We should neither emphasize cooling and the summer functions unduly nor should we help to promote even subconsciously the idea that air conditioning is cooling. The practice of considering cooling as being the function of outstanding importance has arisen recently as a part of the popularizing of the words air conditioning. In order to describe present practices and methods thoroughly it is much more logical to inquire which is the most important function and to make this the basis of division.

Looked at in this way, the answer is at once evident. In nearly all parts of the country the heating season greatly exceeds the cooling season, has always done so, and will continue to do so regardless of how much temporary emphasis may be placed on cooling and the summer functions. All except a few localities positively require the winter functions, while none positively require provision for the summer functions. The facts of the case being as they are, it is logical to regard the winter functions as paramount, and the cooling and summer functions as secondary, though desirable. In other words, the winter functions are of first importance and any attempts at a classification which do not take this into account are apt to be misleading. The cooling tail must not be allowed to wag the heating dog in any broad view of the situation.

Having once decided that the heating function should serve as the basis for the major division, the equipment splits into two general groups—the warm-air group and the steam and hot water group. This grouping requires a definite understanding of the limitations which we set up as follows:

Warm-Air Group: Those methods and equipments in which the heating is accomplished by passing the circulating air directly over metal surfaces made hot by burning fuel on the other side of the surface, and

Steam or Hot Water Group: Those in which the heating is accomplished by warming the circulating air with steam or hot water.

This grouping not only is logical but we have found that it works well in that in most cases equipments or methods which fall into the one group cannot easily be put into the other. In only a few cases is there doubt, and in only a few instances can the available apparatus be placed in both groups at once. Nearly all of the commercial apparatus can also be included in this grouping.

There is also another good reason why this grouping is desirable. For many years the practice of heating and ventilating has followed along these lines. Marketing and sales methods and organizations have been built around this division, and there are indications that as air conditioning for buildings of small to medium sizes grows, the long established trade and selling outlets will have to be more and more widely used. Setting up the methods and equipments into two groups like this lets the "radiator heat" man know what is offered for his use and lets the "warm air" man see clearly what he has. Both can compare their positions as well as their methods.

On these considerations we have drawn up a classification of equipment which should serve the purposes of the heating man and which uses his own terms so far as possible.

Warm Air

A. Integral Type (all parts in one casing).
   1. Furnace, humidifier, fan.
   2. Furnace, humidifier, fan, filter (and/or washer).

B. Units-to-be-added Type (furnace and humidifier in casing, others added).
   1. Fan unit added.
   2. Fan-and-filter unit (or units) added.
   3. Fan, filter (and/or washer) unit, or units, added.

Steam or Hot Water

A. Direct.
   1. Permanent cabinet units, which (a) heat only; (b) humidify only; (c) heat and humidify; (d) heat, humidify, clean and circulate; (e) cool, dehumidify, circulate and clean; (f) heat, humidify, cool, dehumidify, circulate and clean.
   2. Permanent wall-built, flush-mounted or suspended units which accomplish functions as listed above; built like unit heaters or like cabinets concealed.
   3. Portable units, which accomplish functions as listed above, also units which clean and circulate; built as cabinets or for table, floor, window or desk mounting.

B. Indirect.
   1. Metal encased units, which (a) humidify and circulate; (b) clean and circulate; (c) clean, humidify, heat and circulate; (d) cool, dehumidify and circulate; (e) heat, humidify, cool, dehumidify, circulate and clean.

Hook-Ups

The Old and New Warm-Air Plants—Radiator Heat and Air Conditioning

IN order to accomplish the expected results, the factory-built units must be properly connected up and the methods for doing this have not hertofore been outlined from the way a heating man would approach the problem. To us it seems that the easiest way to make the general idea of these hook-ups clear, is to start with the already familiar ones, and to show how they must be changed or modified to accommodate the idea of securing any additional functions wanted.

Again we assume at the start that regardless of how thoroughly the summer functions are provided for, winter heating must be taken care of. In the existing building the heating plant will already be there, and the problem is to modify it or to fit a plant around it to take care of the summer functions. In a new building where summer functions are wanted, the winter plant is still just as necessary as ever. In such cases the obvious way is to plan the plant as a unified whole.

The general use of these hook-ups has come about so recently that here, too, there are no accepted terms at hand. In heating we have well established words such as "two-pipe," "one-pipe," "vacuum," "split," and "combined" which we all use with understanding. In refrigeration practice, too, there are well defined words such as "direct," "multiple," and "remote." We believe that the heating man, though, will do best to keep his own terms so far as possible. In describing some of the present hook-ups we have tried to use our accepted descriptive words so far as possible and to use them in their familiar way.

It seems best, too, to give these methods in diagrammatic form and to show those used with warm-air plants separately from those used with steam or hot water plants. On the following pages are shown in diagram four hook-ups used with warm-air plants and four used with steam or hot water. They are strictly diagrammatic and do not aim to show anything more than the principal parts of the plants. In each case the simple winter plant is shown first and is retained in the following sketches. The parts added to secure the added functions are shown in green, while the black outlines show the parts which would be necessary if only a simple heating plant were wanted. Space does not permit showing all possible combinations and modifications but many of these will be self-evident. Neither can we show diagrammatically all those arrangements whereby particular functions are secured, nor are controls indicated on the diagrams.

Warm-Air Systems

Fig. 1 shows a simple gravity job such as we are all familiar with. It needs no explanation and the caption tells its characteristics.

Fig. 2 illustrates a hook-up where a plant of the integral type—with all equipment in one metal casing—is used. The unit illustrated shows no washer, but some of the integral units contain washers and eliminators. Ducts are all overhead and may be installed without slope and smaller in size than in a gravity plant. The illustration shows the furnace of the same size as in the gravity job of Fig. 1. Actually careful design can make it considerably smaller.

In Fig. 3 a warm-air plant of the units-to-be-added type is illustrated. Use of this method permits attaching the units to existing furnace designs and also makes their installation in existing plants easy. As these units are obtainable singly, any of them may be added as desired, but a fan unit at least is necessary if ducts are to be small with no slope to improve headroom. The filter unit is sometimes omitted when the washer unit is used, the latter acting as cleaner.

Fig. 4 shows a hook-up similar to Fig. 3 except that a cooling and dehumidifying unit is attached. It is the only one of the hook-ups for warm air shown in which the full year-round plant is illustrated. Inclusion of all the auxiliary apparatus in one unit to be added is also shown. Illustration is purely diagrammatic and return of water from bottom of unit to water cooling tank can be accomplished only by the use of another pump, unless a closed type coil is used in the unit. In any of these hook-ups a pressure reducing valve is necessary in front of the spray nozzles if connected to city water.

All the illustrations show full recirculation of air. Any of them may easily be arranged to take outside air and this arrangement is often desirable for spring and fall operation. Basement air may also be used as a supply if desired.

Steam or Hot Water Methods

Figs. 5 to 8 show the hook-ups for the steam and hot water group. It will be noted that the captions for these sketches do not include a separate paragraph listing the functions. Such a paragraph is not necessary because the figures show the plants arranged as year-round systems, and each of them can accomplish heating, humidification, cleaning and circulating in winter and cooling, dehumidification, cleaning and circulating in summer.

Fig. 5 shows diagrammatically a simple direct radiator heating plant of the usual kind familiar to all of us. Fig. 6 shows one hook-up for such a plant when direct cabinet conditioners replace some or all of the direct radiators. The essentials of the winter plant are retained while suitable piping arrangements are made to take care of the summer features. This particular sketch shows the evaporator coil of the mechanical refrigerating plant submerged in the water cooling tank and a pump for use in summer circulation. Evidently the pump could be so placed that forced circulation of hot water in winter could also be used. Instead of using

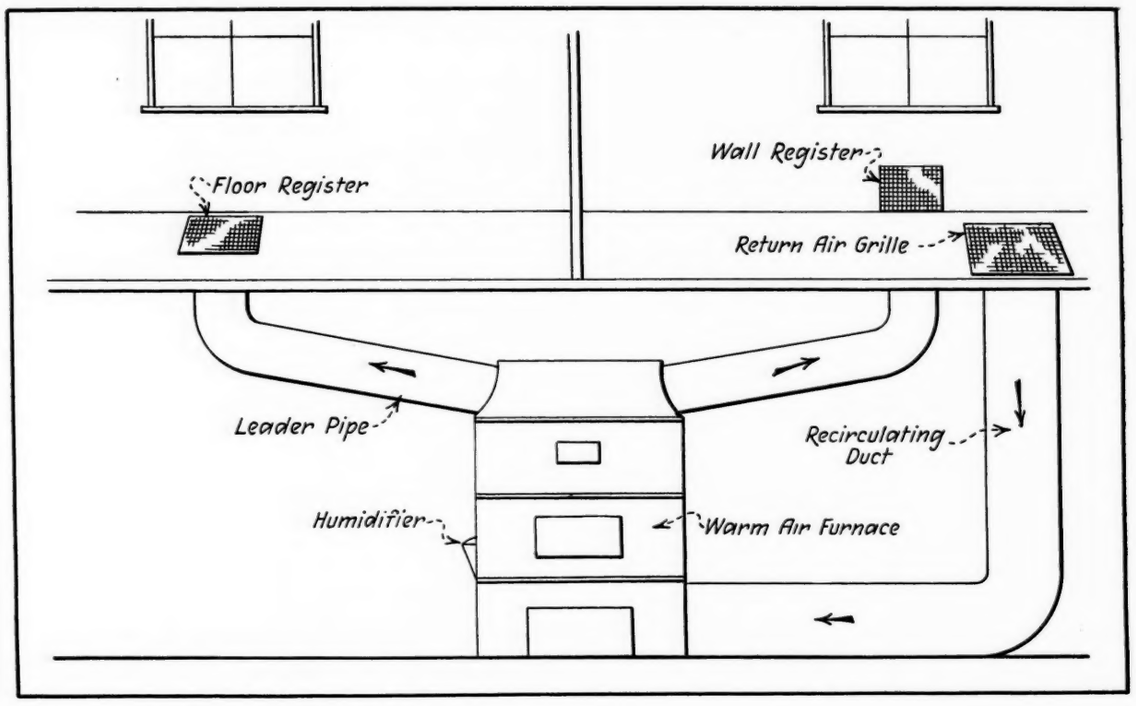


Fig. 1. GRAVITY WARM-AIR PLANT

System distinctly a winter affair, during which season heating and humidification are obtained.

Lead connections at top and return connections at bottom. All piping must be sloped, and gravity flow makes large pipe sizes necessary, resulting in little headroom.

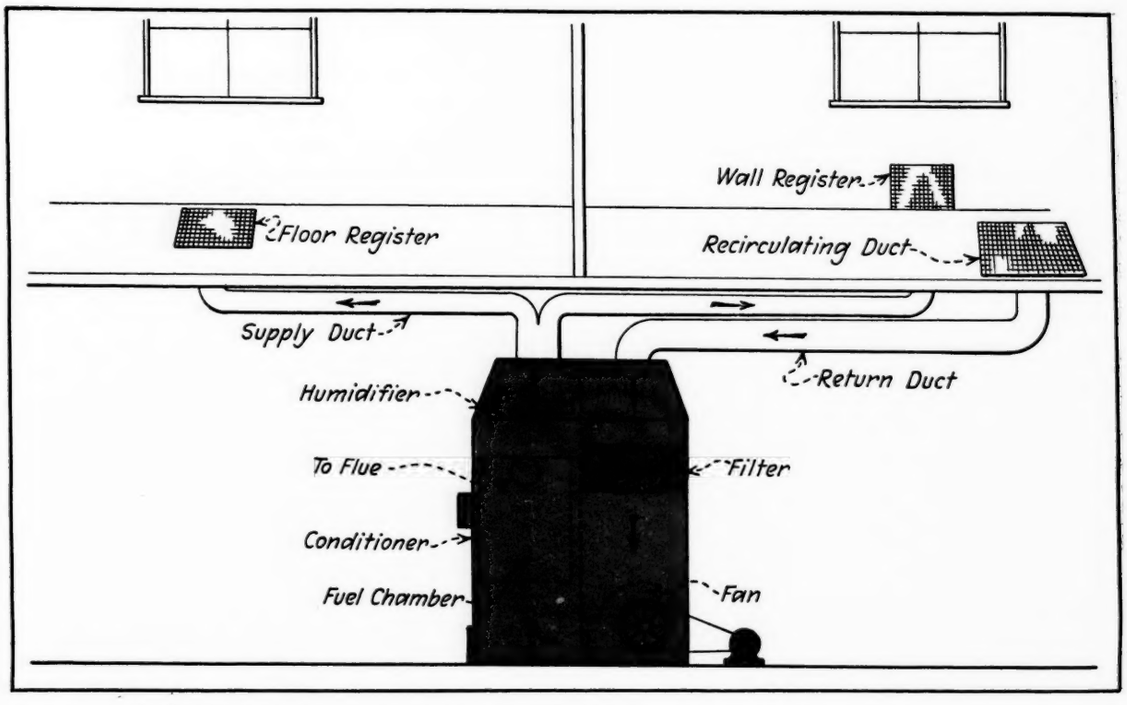


Fig. 2. FORCED WARM-AIR PLANT—Integral Type

As illustrated, can heat, humidify, circulate and clean in winter. Can circulate and clean in summer. As shown, air circulation is only cooling means.

If summer cooling with dehumidification is wanted, a cooling device, such as a spray or a dry surface, must be installed, together with a cooling source, such as cold city water, ice-cooled water, or mechanical refrigeration.

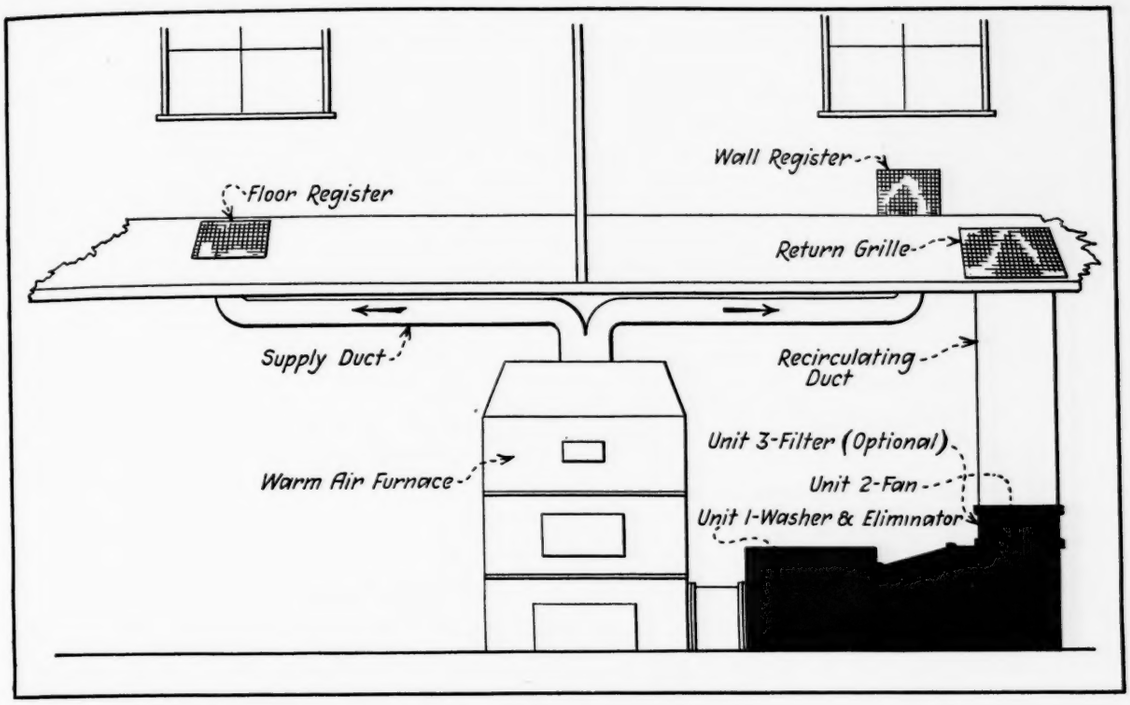


Fig. 3. FORCED WARM-AIR PLANT—Units-to-be-Added Type

As illustrated, can heat, humidify, circulate and clean in winter. In summer can circulate, clean and do some evaporative cooling at washer.

For summer cooling with dehumidification, cold city water, ice-cooled water, or mechanical refrigeration must be supplied to washer unit.

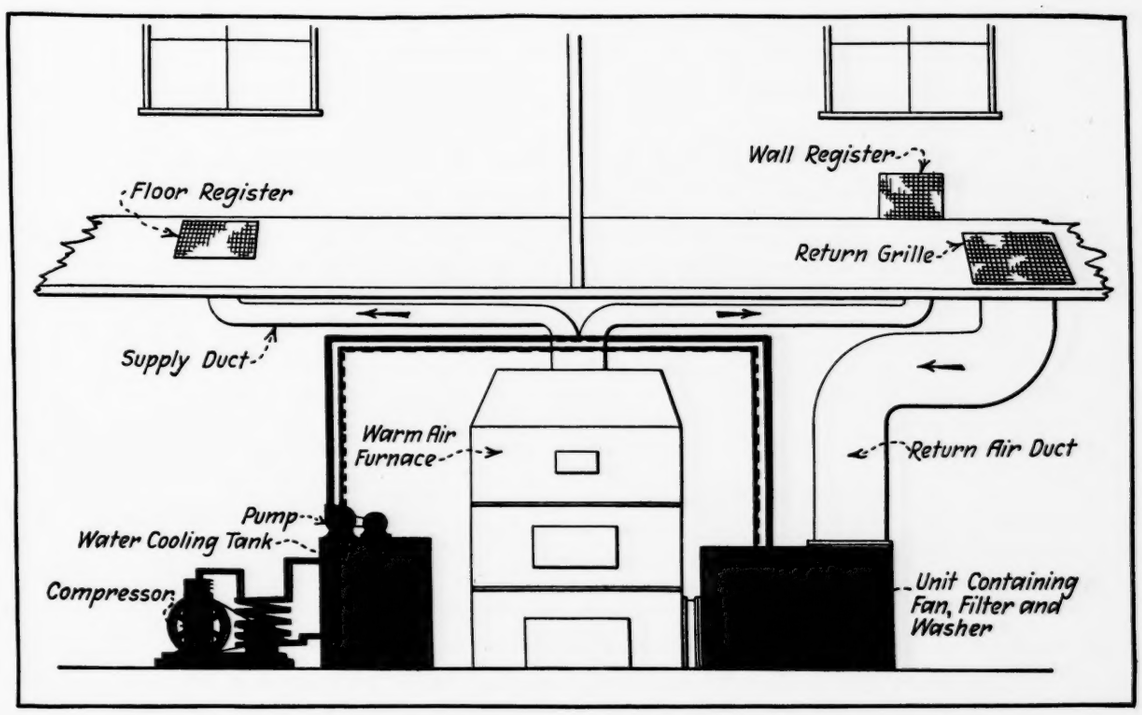


Fig. 4. FORCED WARM-AIR PLANT—Unit-to-be-Added Type, with Refrigeration

As shown, can humidify, clean and circulate in winter. Can cool, dehumidify, clean and circulate in summer.

Illustration shows only one unit added to furnace, but this unit includes fan, filter and washer with a mechanical cooling plant. Can be used without cooling, in which case it is equivalent to plant in Fig. 3. Ice-cooled or cold city water can replace mechanical refrigeration.

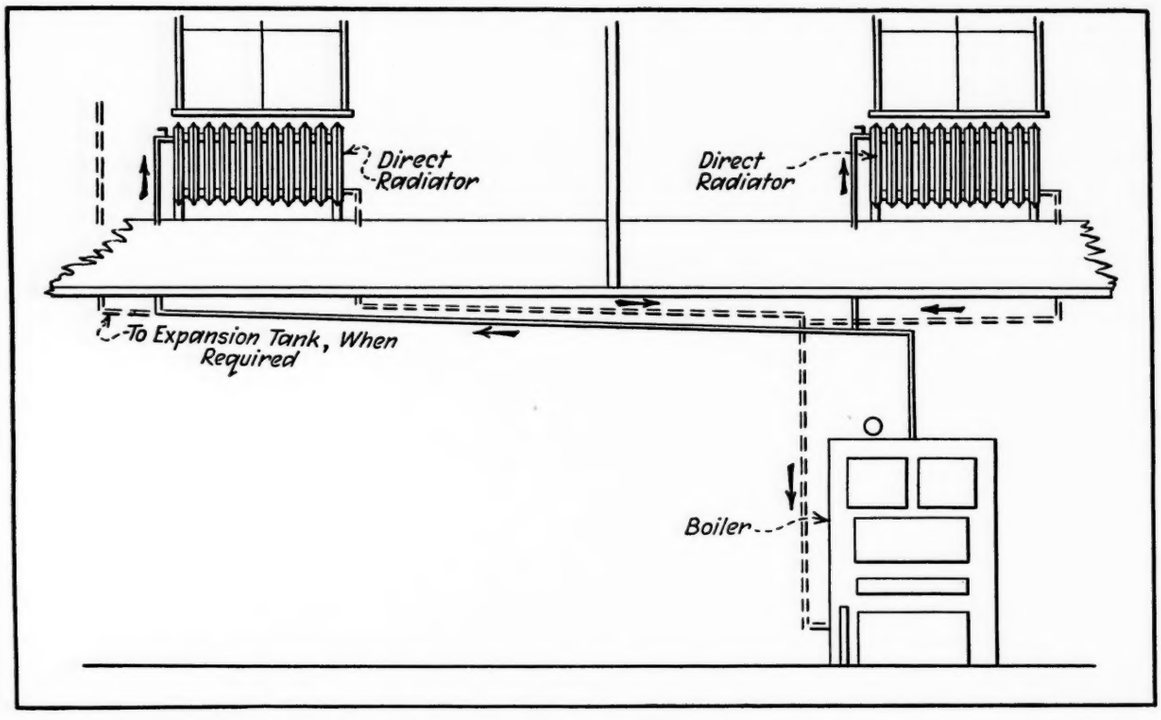


Fig. 5. DIRECT RADIATOR PLANT—Steam or Water

Distinctly a winter affair for heating only.

Humidification may be obtained by humidifying radiators, room humidifier, or central humidifier. Cleaning by window filters, if desired.

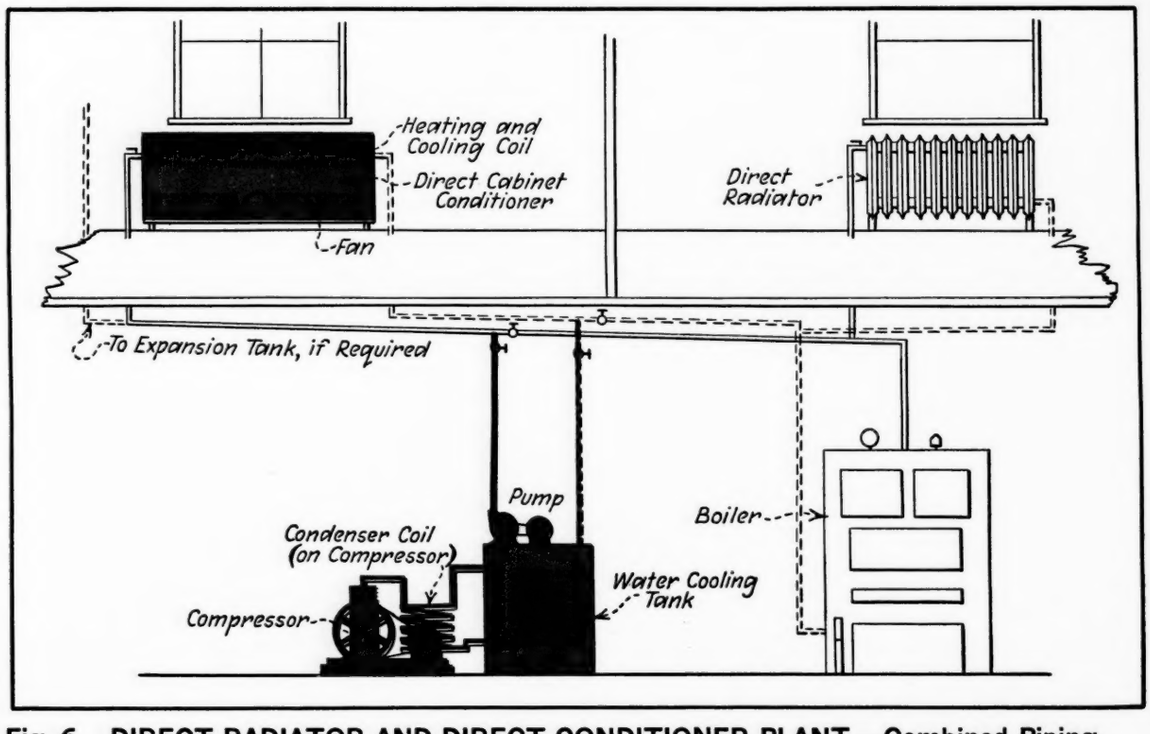


Fig. 6. DIRECT RADIATOR AND DIRECT CONDITIONER PLANT—Combined Piping

Conditioner unit replaces radiator in all or selected rooms. Conditioner units and radiators use same piping as far as possible—limited by insulation.

Alternate cooling arrangements: (1) Ice cooling instead of mechanical refrigeration; (2) unit heaters or unit coolers instead of conditioners or radiators; (3) cold city water through cooling coil when practicable; (4) fan available for air movement cooling.

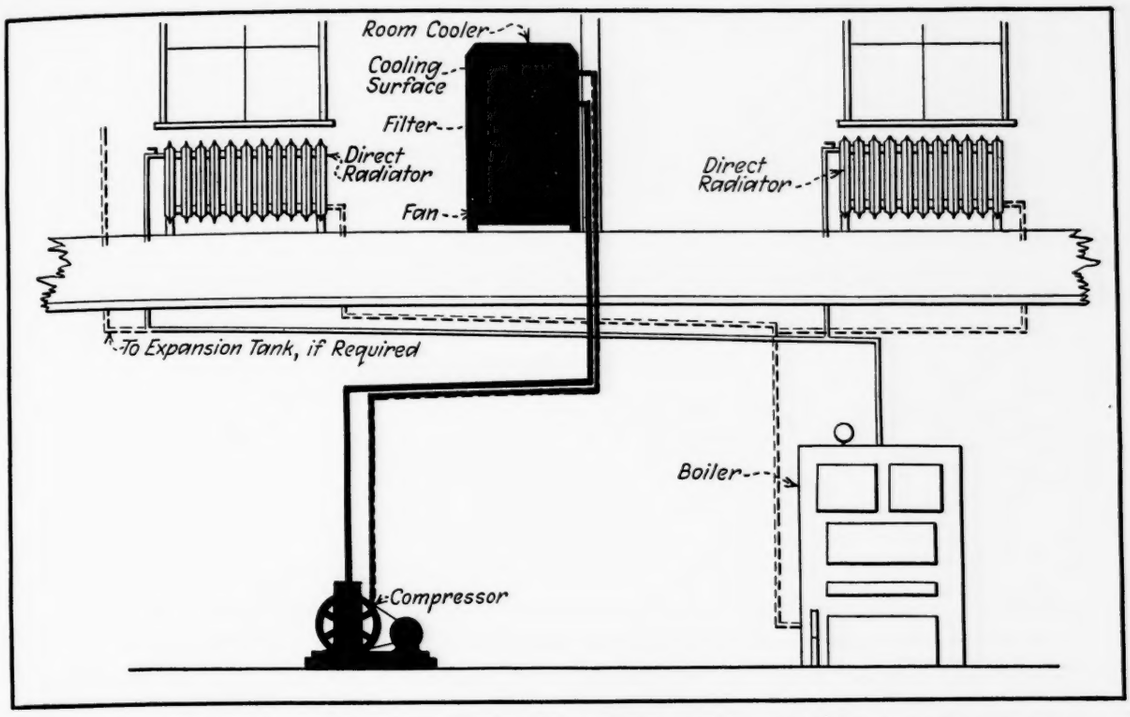


Fig. 7. DIRECT RADIATOR AND DIRECT CONDITIONER PLANT—Separate Piping

Piping for summer and winter plants entirely separate. Conditioners may be placed in all or selected rooms.

Alternate cooling arrangements: (1) Compressor in or adjacent to cabinet; (2) other alternate arrangements same as for Fig. 6.

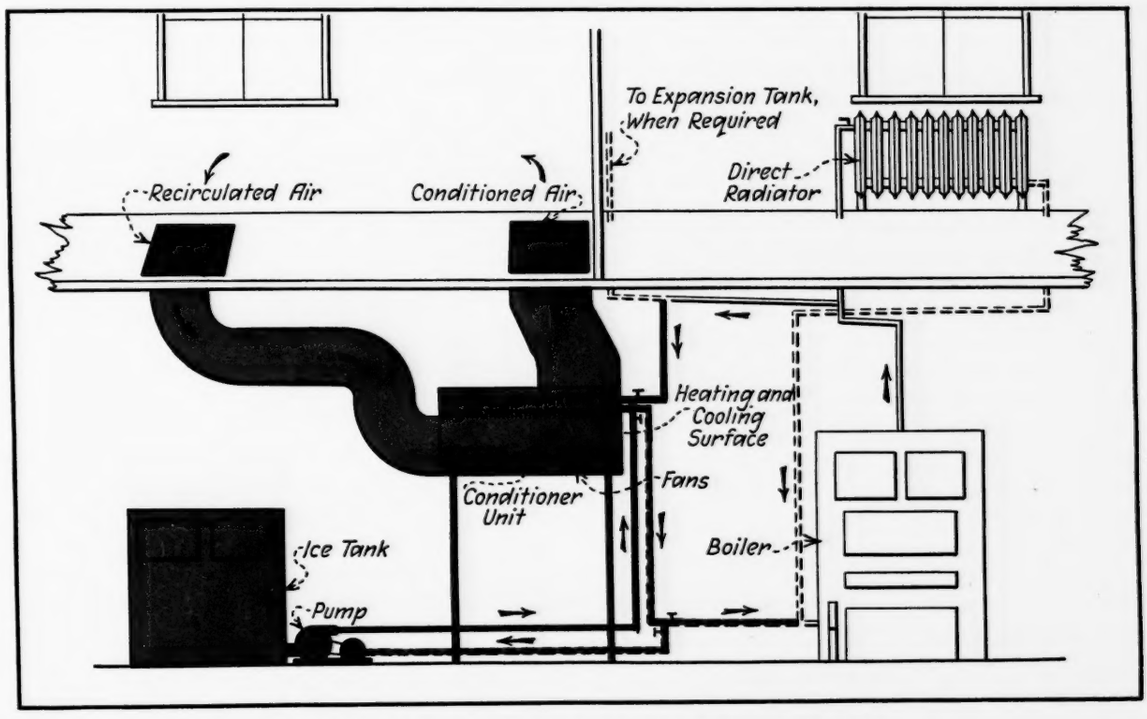


Fig. 8. DIRECT RADIATOR AND INDIRECT CONDITIONER PLANT

Conditioner unit receives hot water or steam from boiler in winter and cold water from cooling source in summer.

Alternate cooling arrangements: (1) Mechanical refrigeration instead of ice cooling; (2) cold city water through cooling coil when practicable; (3) fan available for air movement cooling; (4) unit conditioners (usually behind partitions) instead of basement conditioner.

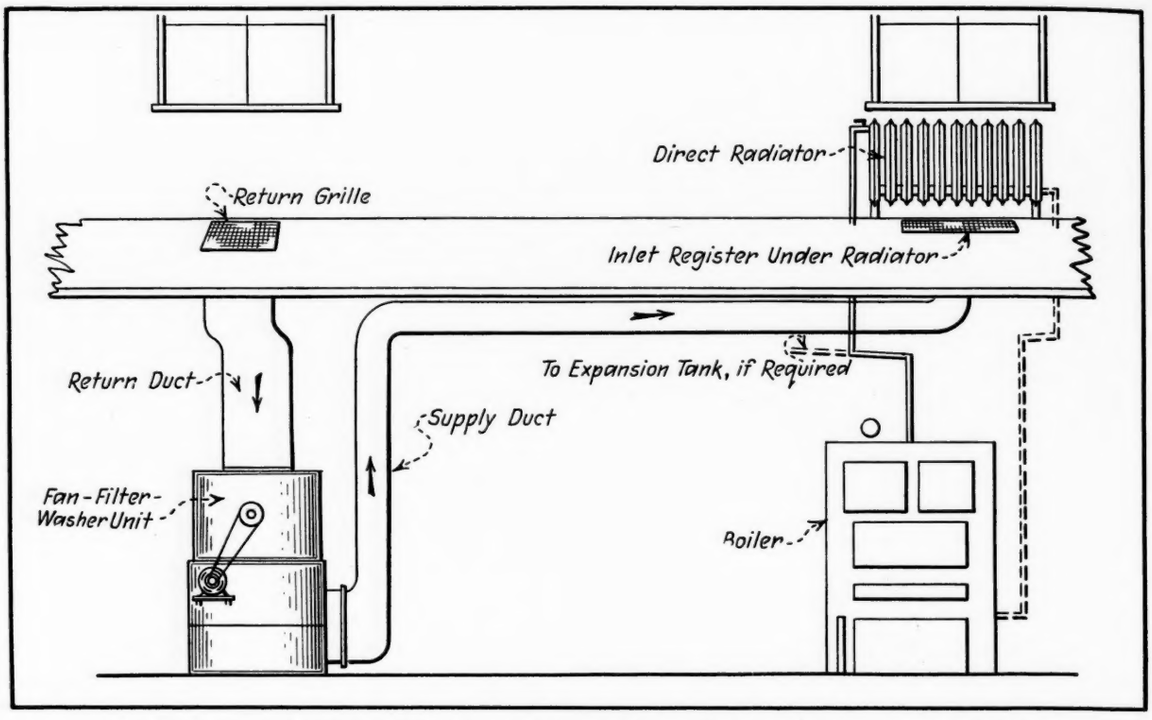


Fig. 9. Basement unit supplying air under or behind radiators. May be used in as many rooms as desired, principally in residences.

circulating water in summer the evaporator coil could be located inside the room cabinet if desired and if local ordinances permit. This general plan thus permits of a number of modifications.

It is especially worth noting that with this plan the same general circulating piping is used in winter and in summer. This is a saving in piping but introduces insulation problems.

Another alternate is to arrange the piping so that the water cooling tank can be used as a water heating tank in winter by supplying a steam coil. The same result can be accomplished by use of a water heating coil attached beside the steam boiler similar to the coils used for supplying domestic service hot water.

Instead of the direct cabinet conditioners shown in the illustration, direct units of the concealed or unit heater styles may be used if desired.

Fig. 7 is similar to Fig. 6 except that the piping system for the summer plant is entirely separate from that for the winter plant. The illustration shows two separate room units, one for summer and one for winter. This method permits adding a summer plant without in any way disturbing the winter plant. By locating the heating surface inside the cabinet, only one room unit is necessary. The sketch also shows the compressor and condenser coil in the basement, or "remote." The compressor and condenser can be built inside the cabinet and the intermediate piping eliminated. Compressor and condenser can also be located in a closet or behind an adjoining partition instead of in the basement—a method used especially where a few individual offices are to be equipped with summer plants. In some localities more than one cabinet cooling coil can be piped to the same compressor—the so-called "multiple" system. In some cities, though, this method is forbidden by ordinance. It should be noted that with this method the refrigerant itself is present in the cabinet—the "direct expansion" idea being used. Introduction of the refrigerant into the cabinet may be avoided by using a water cooling tank, as illustrated in Fig. 6, and the summer piping may still be kept separate from the winter piping. Use of this plan also avoids the difficulty of ordinance limitations on multiple connection of cabinets.

As in Fig. 6, concealed or suspended direct units may be used instead of the cabinet model illustrated.

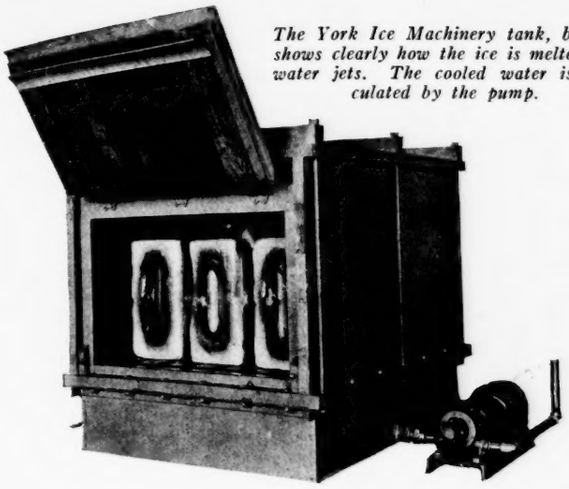
Fig. 8 illustrates a hook-up using an indirect type conditioner installed in the basement reasonably close to the heater, and supplying certain rooms, while the others use only winter equipments. This idea is essentially the same if all rooms are connected to the conditioner instead of selected ones.

This general method has some notable variations. For instance, instead of the heater and conditioner being built as two separate units they can both be built into the same metal casing. This plan reduces the connecting piping to a minimum but may require more ductwork. When built as two units, the heater may be located convenient to the stack and the conditioner unit placed close to the conditioned space. This reduces the ductwork to a minimum. With this plan, too, a number of conditioners may be served from the same heater and may be located on different floors.

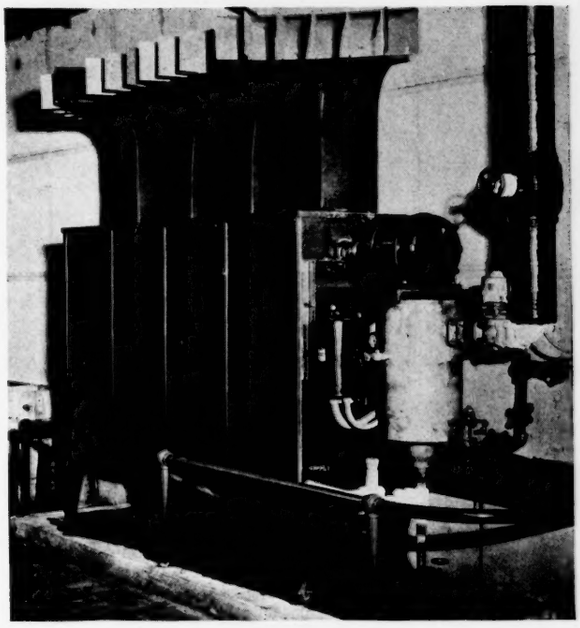
The sketch shows ice being used as the cooling source, but mechanical refrigeration can also be used if desired, as can cold well water. Separate refrigerator plants can be used with each conditioner if desired instead of a central cooler.

Full recirculation of air is also shown, but the conditioner unit can be connected to outside air if desired.

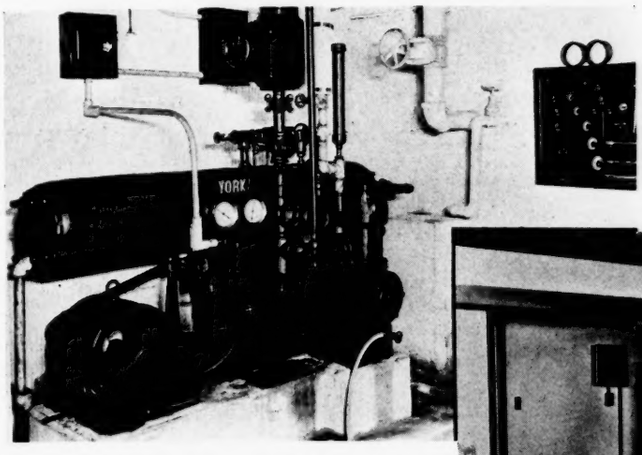
Fig. 9 illustrates a plan which uses the units commonly added to a warm-air furnace plant and applies them to buildings where a steam or hot water plant is used for heating. Openings are located under or behind radiators and the air which has passed through the units is introduced here.



The York Ice Machinery tank, below, shows clearly how the ice is melted by water jets. The cooled water is circulated by the pump.

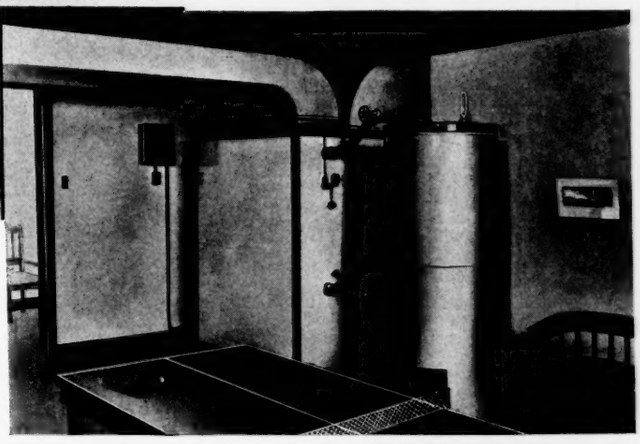


The Clarage unit air conditioner, above, can be used directly and concealed behind the walls of the conditioned room, or ducts can be run to a remote space.



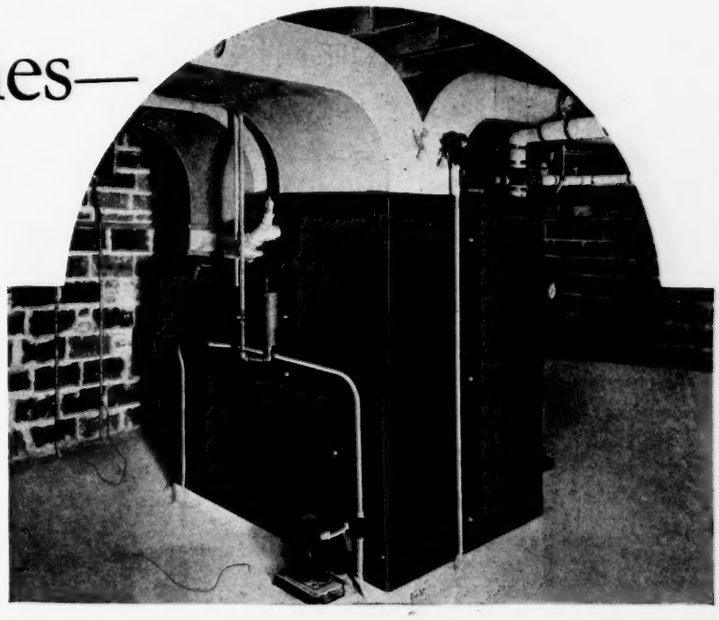
One of the 8½-ton York freon refrigerating units in the basement kitchen of the Oreole Cafeterias, Inc., Baltimore. These units have a load of 35,000 cu. ft., 250 people, 4000 watts, 1750 c.f.m. of outside air, and kitchen equipment.

The American Blower indirect conditioner unit, below, can be connected to any steam or hot water boiler.



Behind the Scenes—

Many important parts are often concealed or in the basement.



The gas-fired Bryant Dualator can supply radiators with steam, and in addition furnish air to the room through ducts.

Space does not permit showing any of the detailed hook-ups now in use, but brief mention of some of the unusual ones is possible. One method uses an ice-freezing and melting tank on which the compressor works steadily in summer. This permits the installation of a smaller-sized compressor than would be possible otherwise. Another uses the heat from the flue gases to warm the conditioned air in winter. Others use converter tanks for heating hot water from a steam supply. One special summer system uses a chemical method of dehumidification and requires a hook-up all its own. Another uses steam as the refrigerant.

The very fact that developments are taking place so rapidly makes it impossible to draw any conclusions as to which of the many methods of installation will survive. It is quite possible that no few methods will be found best, for the many combinations possible will probably make each job continue to be a special problem to be solved to meet its own requirements. An economical hook-up under one set of conditions may be unjustified in another even after we have had enough years of use to gather full information. Certainly at present there is no standardization along these lines.

Conditioning Units—What They Are and How They Work

DIVIDING up the standard equipment on a basis intelligible to the heating man and noting enough of the general hook-ups to make the relation between our older installations and the new equipments clear is not enough. We ought to know in what variety the several types and styles of equipment are now at hand and something about their group characteristics. In discussing them we can follow the groupings already set up in the classification on page 26.

Warm-Air Group

As the warm-air methods have to send the air past the hot surface they must necessarily be of the "central" type in small buildings. In larger buildings it would be quite possible to use them as unit methods. So also it would be quite possible to utilize them as direct methods. As used now, though, in small buildings the warm-air method is central and indirect, considering these words in their common meaning.

One heating unit per small building or per group of rooms with the unit in the basement is the accepted method just as when used in the older installations. For this reason it is not necessary to consider the warm-air group as to position of unit.

There are, however, two types of these plants. One is the plant where the fuel-burning space, the air passages, fan, filters, and all other auxiliaries are built into one sheet metal casing. These units commonly leave the factory assembled, and erection consists of setting them in place and making the necessary connections. Such units we have called "integral."

Integral Type Units

These units have some interesting characteristics. Since most of them are factory-built and factory-assembled, space saving is both possible and desirable, for they must be small in order to be capable of reaching the site. As a result their auxiliary equipment is usually carefully located with an eye to space saving. Many of them make use of gas as the fuel. Their heating surfaces are often ingeniously arranged. Not all of these integral designs are factory assembled and must be put together on the site. In most cases they are especially designed throughout.

Units of this type are available in a wide range of sizes and capacities and of the amount of equipment included. Some include furnaces, fans and filters only, while others include also washers, humidifiers, complete controls and cooling provisions.

Units-To-Be-Added Type

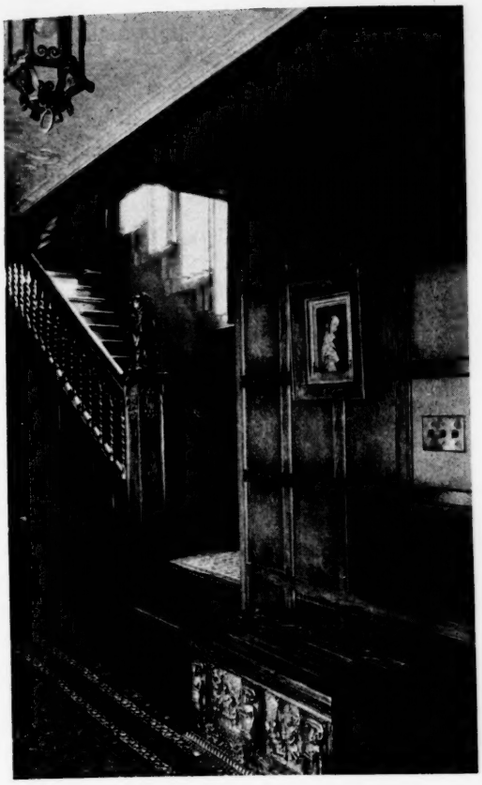
The second type of warm-air plant consists of those in which the fuel-burning space and heating surfaces are enclosed in a separate sheet metal casing while various pieces of equipment are added to this to accomplish the functions desired. For want of a better term we have called them the "units-to-be-added" type.

A great variety of these designs is now on the market. Some add as many as three separate and distinct metal-encased auxiliary units to the furnace. Others add only one such unit. The separate units are usually factory-built and factory-assembled and are delivered to the site ready for connection.

The number of separate units added to the furnace is not a measure of the number of functions which the complete plant can perform. Thus there are units which permit humidification, cleaning, some cooling and circulation, all enclosed in the same casing. Adding such a unit to the furnace permits the plant to perform all these functions. Other units accomplish but one or two of these functions, and in order to get them all accomplished it is necessary to add several units. Designs have been worked out which permit these units to nest together like sectional bookcases.

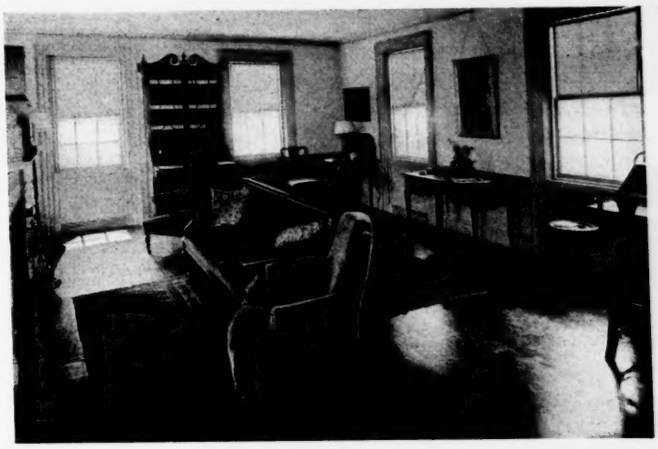
Plants made up of assemblages of units permit the use of existing designs of warm-air furnaces and permit inserting such units into existing installations. Their typical use is under these conditions. They often have to sacrifice some compactness of floor space, although the nesting idea makes them compact. The single units make use of space to advantage.

In this connection it is interesting to note that a number of separate units are offered for sale independent of the furnaces. The most common of these units is



Behind the grilles in this attractive residence is located a Betz unit conditioner which cools the room by melting ice.

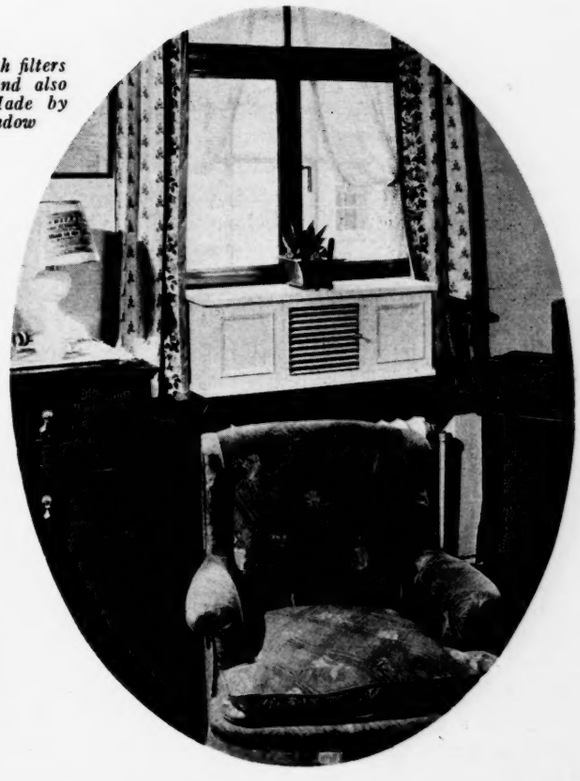
A Bon-Air humidifying radiator heats and humidifies this room. The water level in the humidifier is automatically controlled.



Erskine Thermoist cabinets recessed under the windows. The cabinets are connected to the heating boiler, and in addition to heating, supply moisture to the air.

For Comfort and Health

A neat window unit which filters and circulates the air and also contains a silencer. Made by Campbell Metal Window Corporation.



The Sturtevant humidifying-radiator heats, moistens, and circulates the air in this cozy room.

the one which is a fan unit alone or a fan-and-filter unit. In most of these units the filter is of the dry or viscous liquid type and is arranged for easy removal and cleaning or replacement. Another of these units is a washer unit with the use of spray type washers the most common. A third unit is a separate filtering unit. Some makers offer a line of all these units so designed that they fit together readily. This plan permits the inclusion or exclusion of any of the units at will.

As these units reach the site assembled, the stock designs are limited in size to dimensions which will permit their passing through door openings.

These units are readily applicable to existing furnace designs regardless of the kind of fuel used.

Steam or Hot Water Group

Since with these methods it is not necessary to carry the air to a central point for conditioning unless one wishes to do so, the principal point concerning these types is that of whether or not the conditioning is done by units located inside the rooms or outside them. In the same way that we use the terms "direct radiators," "indirect radiators," and "central-fan systems," we can use the words "direct conditioners," "indirect conditioners," and "central-fan conditioners" to describe and classify the apparatus. The conditioner simply takes a place in the system exactly similar to that occupied by the heating surfaces in the straight heating systems. Instead of being intended for heating only it is also designed so that it can carry out cleaning, circulating, humidifying and dehumidifying, and cooling, or as many of these functions as are wanted. Apparatus is available which will carry out any combination of these functions desired, so that some rooms can be heated and others conditioned.

The direct units are of three types, as indicated in the classification on page 26. Each type can be had in styles which perform from one to six functions. They thus vary all the way from strictly winter apparatus and strictly summer apparatus to those which should be used the year round.

Units of the first two types—the permanently placed cabinets and the wall and suspended units—are connected to piping. The portable units are connected to electric outlets only, and any heating they do makes use of electric energy for the purpose, and consequently they are little used for heating.

Permanent Direct Units

The permanently located direct cabinet units are divided into six styles in the classification on page 26. Some of these styles can be further subdivided, and some have distinctive names which are accepted as belonging to them. Thus style (a) is the familiar cabinet radiator; style (b) is the cabinet humidifier; style (c) is the gravity humidifying radiator; style (d) is the mechanical circulation humidifying radiator; styles (e) and (f) are the so-called cabinet conditioners. In addition to these styles there is at least one cabinet unit which reduces outside noise.

The cabinet radiator is so familiar to all heating men that we do not need to mention it further.

Direct cabinet humidifiers add moisture to the air by methods which do not heat. If they add heat, we regard them as falling in the type which we call humidifying radiators. In order to get good contact between air and water these cabinets are designed so that either the water is broken up or "atomized" or else an air stream is driven against a water surface or bubbled through water. Some use a fan for circulation while others depend on either gravity air flow or the flow induced by the jet effects of the water. Evidently some of these units can do evaporative cooling, although most of them are obviously intended for use during the winter months only. If supplied with cold enough water they can cool and dehumidify.

Direct cabinet humidifying radiators are of both the fan and gravity types. They are definitely a part of the steam or hot water systems and replace an ordinary radiator. They both heat and humidify. One type causes water to drip in a thin film over a series of hot metal surfaces. The excess water is drained off at the bottom. Air comes in contact with the hot, wet surfaces of the radiator and is heated and some of the hot water evaporates and is carried off with the air. Others use spray type humidifying devices. These cabinets can also be used to accomplish some cooling. If supplied with cold enough water they *can* cool and dehumidify but usually are not featured to do so, but are looked on as winter equipment. Many of these styles have been used for some years and are well known to heating men generally.

The cabinet conditioners styles (e) and (f) on page 26, are the ones which are most recently developed and the ones about which heating men are least informed. Both are provided with equipment which permits their use for summer cooling. They have recently made their appearance in such a variety that they will stand considerable explanation.

The simplest of these cabinets contains only a finned or extended surface and a fan. The most complete ones contain a full cooling plant and means of heating as well. Between these limits there are direct cabinet units which may contain separate heating and cooling coils, filters, humidifiers, etc.

Take the simplest case first, where a cabinet contains one coil and a fan. A heating substance must pass through the coil in winter and a cooling substance in summer. The easiest way is to use water in both cases and one set of circulating piping attached to the cabinet will accomplish the result. The path of the water may be controlled with by-pass valves, and both the heating and cooling equipment is located outside the cabinet either close to it or some distance away.

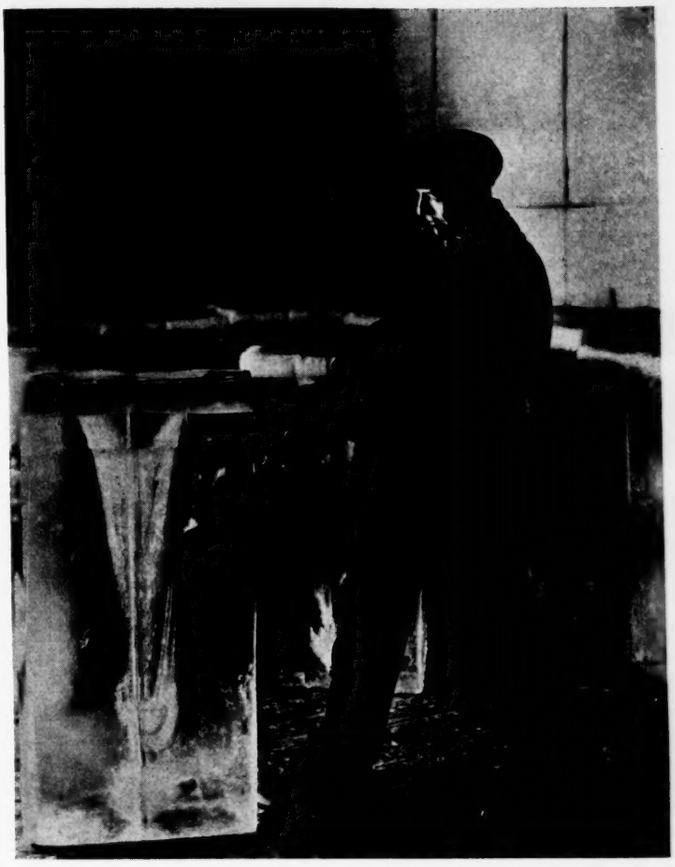
At the other extreme lies the cabinet into which both heating and cooling apparatus is built. Its connections for cooling and dehumidifying are usually factory installed and require connection to water and waste only. In addition it must be connected to the heating supply and return. These cabinets may be obtained either containing filters, humidifying devices, etc., or without them.

These cabinet units usually have coils for cooling and do not use spraying methods. Also while they may use direct expansion of the refrigerant, the coil employed for the refrigerant is not the same coil used for heating.

Before passing to other classes of units it is worthwhile to note that there are several important points

regarding all these direct cabinet year-round units which should be looked into. First, they must be well and durably finished in order to carry any appeal. Second, they must be compact and not take up excessive floor space. Third, they must operate quietly. Fourth, they must contain a fan if they are to be used for both heating and cooling. Fifth, they must not sweat during the summer. Sixth, they must not leak. These points are in addition to the basic ones of sound construction, adequate size, and a fair price.

So far we have described only the permanent direct cabinets. Almost exactly similar to them in function are the wall-built or flush-mounted units. These are essentially the direct cabinet units arranged for building into the walls either wholly or partially. Most of the makers who offer cabinet type units are also prepared to make recessed or concealed units. They are thus available in the styles just described.



Courtesy York Ice Machinery Corp.

"Cooling is by no means the least important phase of air conditioning, and the future for accomplishing this with ice is promising. This is particularly true in the case of the smaller buildings."

These units offer the same equipment as the direct cabinet units but often permit of a little more space. The several points listed in connection with cabinet units apply equally to them.

Another class of direct unit is that in which a heating-cooling surface is located directly in front of a propeller fan. They closely resemble the familiar suspended type of unit heater. In order that they may be used where cooling is practiced it is necessary to provide for handling the moisture which is extracted from the air when dehumidifying. Some of the units do this by placing eliminating plates in front of the heating surface with drip pans to catch the moisture. The usual deflector vanes are located in front of the eliminator plates.

Some of these units have found increasingly wide use as air coolers in existing buildings, being installed separate from the heating plants. In such cases they are piped to the cooling water or refrigerant only. In other cases they are so arranged that either heating or cooling may be accomplished by their use. In this case they must be piped to both heating and cooling lines. Most of these units do not incorporate any humidification apparatus. Some, however, do contain this equipment. These units may be had for either direct or flush mounting.

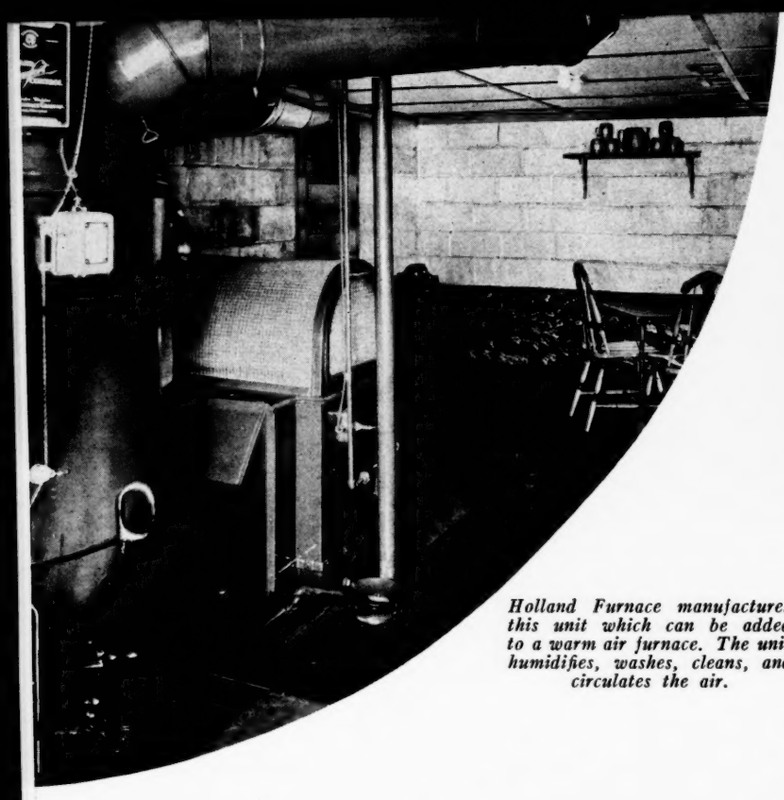
Direct units closely resembling in outer appearance the floor-mounted unit heaters so popular for industrial heating are also available for conditioning. We call them unit conditioners, to agree with our idea of using familiar descriptive words.

They frequently use centrifugal fans which can operate against great enough resistance so that considerable ductwork can be attached. This makes it practicable to use them as indirect units. This is sometimes a great convenience where floor space is valuable and the unit can be located behind a falsework partition or in an adjacent room. For direct use the units are nicely finished in order to present an attractive appearance. These units often use spray heating and cooling together with coils and are built in sizes which permit each unit to condition a fairly large space. No example is known where one of these units contains a complete set of refrigeration equipment built into its casing. These units may be regarded as intermediate between direct and indirect units, and in some cases they can be placed in either or both groups.

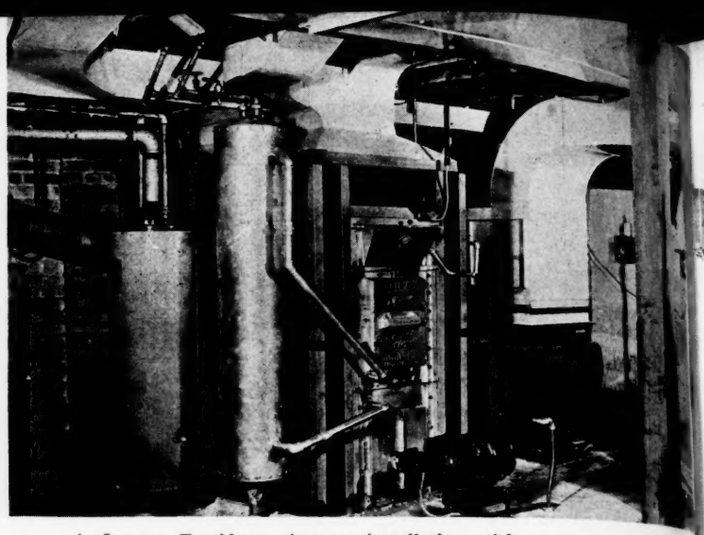
Portable Units

In considering the portable types of direct units we know that there may be some question as to why they are assigned to the steam or hot water group instead of to the warm-air group. Since they are portable and are not connected to any piping, they can be used where there is either a warm-air or a steam or hot water plant. We place them with the steam or hot water group because this results in a fairer picture, we believe. Warm-air plants can accomplish humidification readily at the central furnace and the location of humidifying devices at this point is the typical method. With steam or hot water, however, humidification is readily accomplished in the rooms themselves. We have noted that the portable units are seldom equipped for heating to any extent. When cooling is desired it is also true that cooling at a central point can be so readily done with a warm-air plant that to cool in the room itself is not the typical method. For these reasons we believe that our assigning of these units to the steam or hot water group is logical and justified, although it is true that they are not a part of the heating installation proper in these cases.

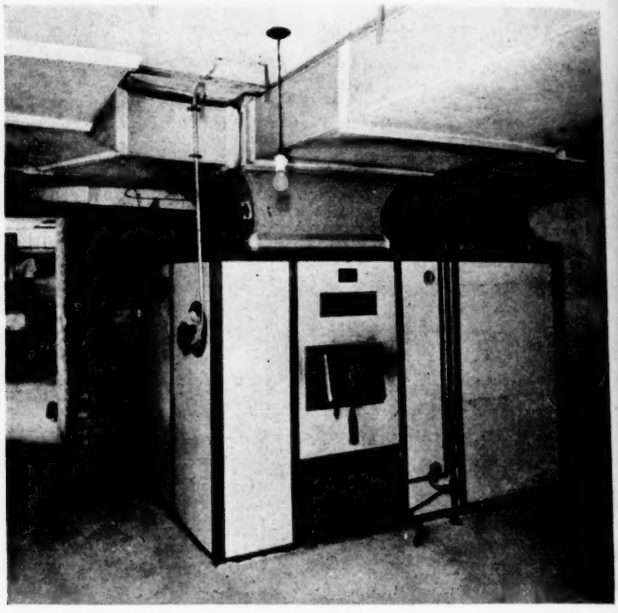
The older of the direct portable units, and ones with which heating men are familiar, are the humidifiers. They are available in many designs having the outward appearance of pieces of furniture or pottery, or urns.



Holland Furnace manufactures this unit which can be added to a warm air furnace. The unit humidifies, washes, cleans, and circulates the air.

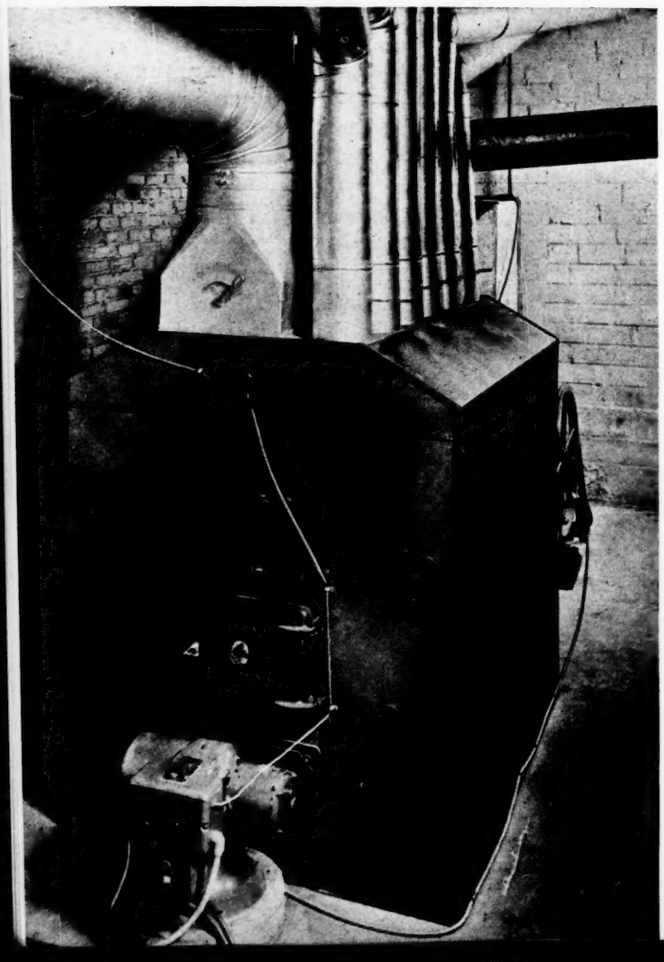


A Lennox Torridzone furnace installation with a washer, filter, and fan added.



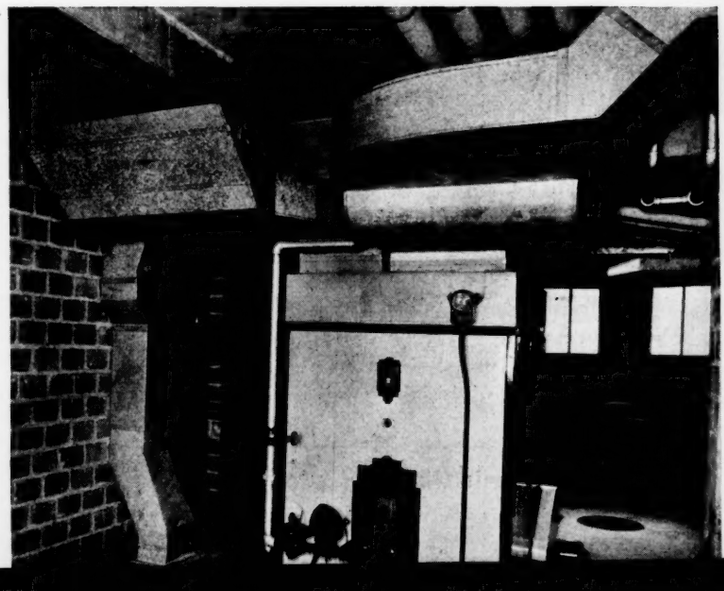
A Kruse gas-fired conditioner in an Indianapolis residence.

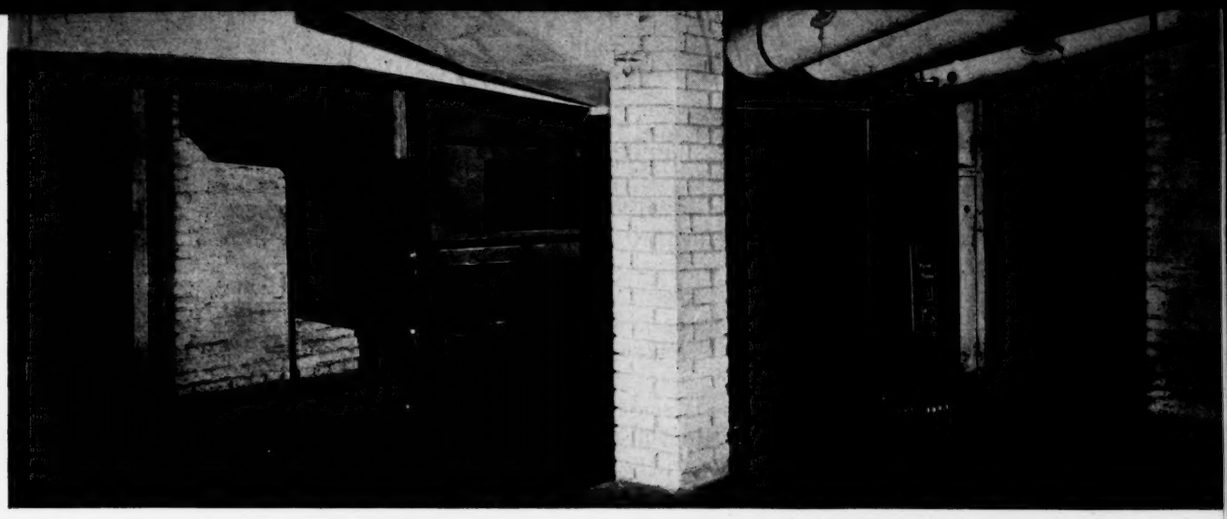
A Mennonite church in Elkhart, Ind., is supplied heated, moistened, and cleaned air by this Dailaire unit, fired with a Petro oil burner.



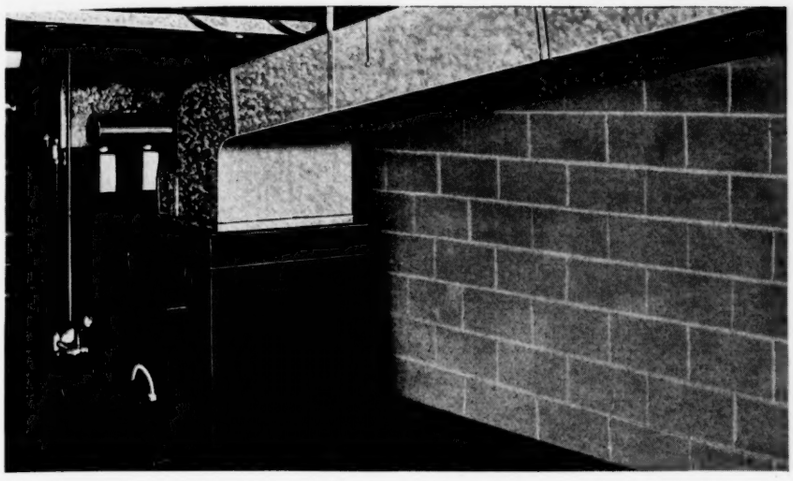
Some Typica Warm-Air Fu

Surface Combustion makes this compact gas-burning conditioning unit.

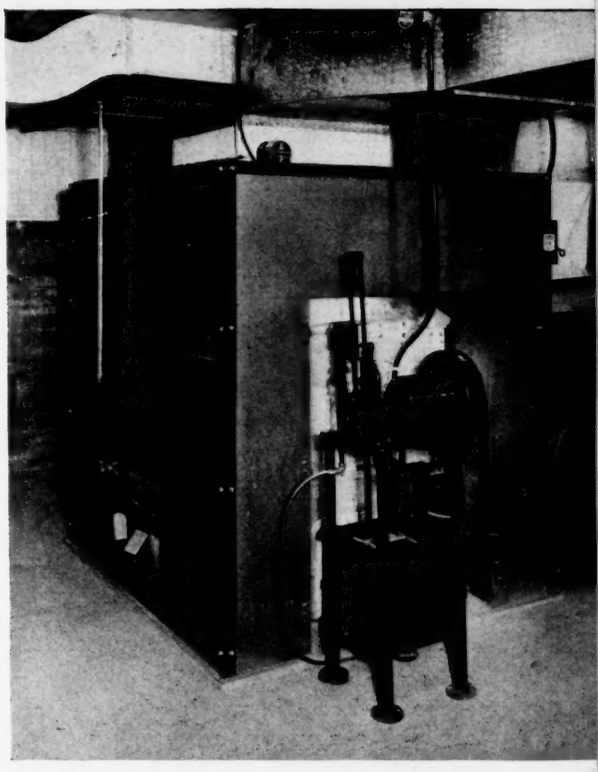




Basement view of a Rochester, N. Y., home conditioned with a Kelsey ConditionAire.



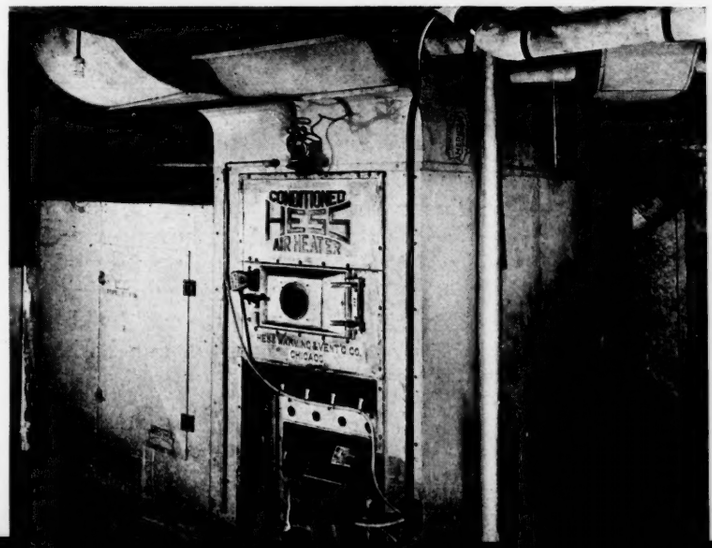
An L. J. Mueller furnace equipped to wash, filter, heat, and circulate the air.



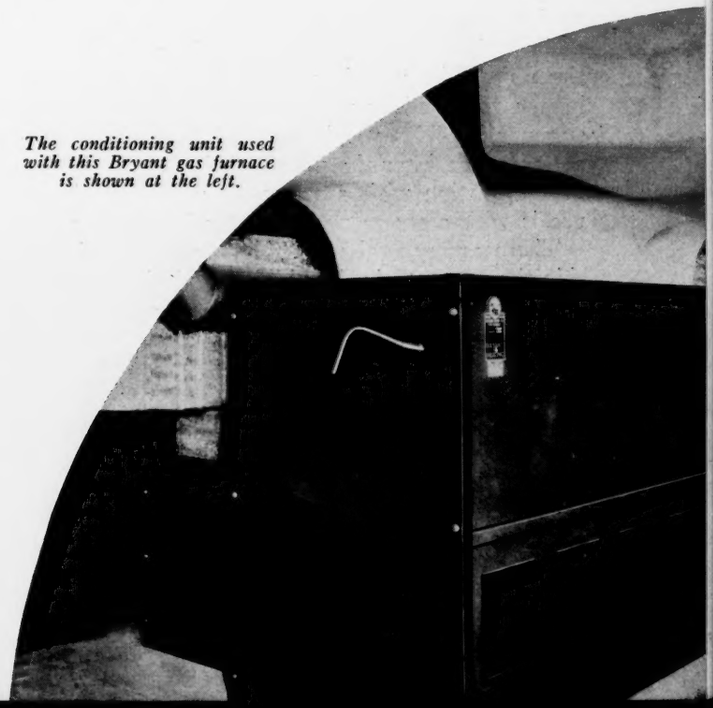
An oil-fired Fox Sunbeam basement unit which heats, circulates, humidifies, and cleans the air in an East Aurora, N. Y., residence.

Installations of Furnace Conditioners

A Timken oil burner used with a Hess furnace and conditioner unit.



The conditioning unit used with this Bryant gas furnace is shown at the left.



They are for desk, wall, or floor mounting and require plugging into an electric socket only. In these cases they must be supplied with water manually. They often contain a fan and use atomizing methods of securing evaporation. Others simply heat water to cause evaporation. They are essentially winter devices, although they may be operated in the summer if desired.

Portable units which clean and circulate are usually for window mounting. They require connection only to an electric outlet. They are used largely because of the cleaning function, some of them being said to remove fine dusts and plant pollen from the air.

Portable units which accomplish all-the-year-round functions are not common. Where any considerable amount of heating is required the use of electric current for accomplishing it is usually too expensive.

Portable summer units which use ice as a cooling source belong in this group. For large spaces they must be installed in multiple. Ice capacity of 250 lb. to 300 lb. is usually provided in order that a standard cake may be charged at one time and that charging may not be required more than once a day. Being equipped with casters, the units may be rolled into position and removed to a central icing point. Finished metal cabinets are usually provided. Since they require connection to an electric outlet only, they are convenient for use in existing isolated rooms and are popular for hotels, offices, and living rooms. They are so arranged that air may be passed either over the ice or across a dry coil through which ice water is circulated. Where a dry coil is used the unit contains a fan, coil and pump. The units must be protected against sweating, or the water condensed on the outside surface will become a nuisance. If sweating is not prevented, means of collecting and disposing must be provided.

Indirect Units

Indirect units used with steam or hot water systems are also available in considerable variety of form and shape, and contain varying items of apparatus to accomplish one or two, or more functions.

Among the winter equipments are several which are for humidifying and circulating. In some cases, too, they do some heating. Several are arranged for using the hot flue gases to supply heat to evaporate moisture.

In one case, at least, the air is passed across the surface of the flue piping, picks up moisture, is heated, and sent back to the heated space by a fan located near the unit. The unit is necessarily placed close to the heater. It can be used to accomplish some cooling in summer if cold water is supplied to it, and its fan can act as a circulator the year round. It can also be used in conjunction with a warm-air plant, but its typical use is with a steam or hot water installation.

There are several units which are located just outside the space to be humidified and their ductwork is a minimum. They are indirect, but not central. Their use is principally for humidification and circulation also, but they *can* be used for cooling and circulating.

Another unit of this general kind contains a filter, spray and a dry heating surface. It is central and indirect. All the circulating air passes through it and is returned to the conditioned space by a blower.

The central indirect units intended definitely for year-round operation constitute an important number of this class. They must be supplied with steam or hot water in winter and with a cooling medium in summer. In general they use a dry surface cooling coil and cold water either from city lines, from an ice tank, or from a mechanical refrigerator. Some few are definitely supplied with mechanical refrigeration units for summer cooling as a part of the system used.

These units can be more generously dimensioned than can the direct units, for space-saving is not relatively so important. As they are factory assembled they must be small enough to pass through door openings. Space permits the use of filters and often a separate coil for cooling and another for heating. Some use two coils in series. Centrifugal fans capable of operating against considerable resistance are popular. Controls are usually included, as is provision for winter humidification. Some provide for connection to outside air and for means of mixing outside and return air.

It is interesting to consider the essential differences between steam and hot water systems and warm-air systems in small and medium-sized buildings where factory fabricated units are used.

These buildings are of such size that usually it is neither feasible nor desirable to have more than one fire unless a gaseous fuel is used. Even then there is a strong tradition that all the fuel be burned in a central place, and most of the equipments now available tacitly presuppose this condition. Under such circumstances there is no recourse with a warm-air system except to circulate the air past the furnace. With this arrangement there is a considerable amount of sheet metal work to be done during installation. On the other hand, all the air is passing a central point and may there be readily processed as desired. Where a central steam or hot water plant is used the heat may be carried a considerable distance and the processing done there. When direct units are used, the air need not be taken out of the room, but may be processed right inside the room. Thus, in the warm-air plant, ductwork is always a considerable part of the installation, while with steam and hot water, piping constitutes a comparable part.

If ducts are to be erected for carrying the air during the heating season, it is evidently not economical to install something else to carry the air during the summer season. Such processing is therefore best carried out at or near the central furnace.

In the same way when piping is being erected to carry the heating medium, it is also economical to try to use as much of this piping as possible to carry the cooling medium during the summer. For this reason the cooling processing takes place where the piping can be used to advantage. The insulation problem with piping used both for summer and winter is complicated and not yet solved satisfactorily.

In spite of these inherent differences the same overall results may be accomplished by the use of either class of equipment. What will differ will be the initial and operating costs of accomplishing the results. Developments are taking place rapidly, but there is no information now available which will let anyone predetermine which method will be most satisfactory in any given case. Neither is there any indication that the spread of the use of air conditioning to small buildings will eventually result in either of the two basic methods forcing the other out of use.

Conditioning Units—A Reference List

ON the following pages we present a comprehensive listing of the factory-built and assembled units which find use in small building air conditioning.

In arranging the material we found it difficult to decide which products of a manufacturer to illustrate, since it was not practical to illustrate all. In making the choice we tried to select the product which bears most directly on the subject matter of this issue of the magazine. In some cases the equipment illustrated is distinctly adapted only for small- to medium-sized buildings, while in other cases it is equally well adapted to use in even the largest buildings for comfort work. The fact that a piece of equipment is included does not mean that it necessarily is for small buildings only.

In deciding what products to include, it first seemed that a fair yardstick would be to include only those which the makers themselves referred to as "air conditioning" equipment. The confusion of words made this impossible, for we found that of two devices almost exactly alike in function, one maker would call his product air conditioning equipment, while the other would call his by a different name. It may be noted in passing that at least some manufacturer of each type of unit included refers to it as accomplishing "air conditioning."

As a result of the confusion we decided to use as a basis the groups set up by the classification on page 26, excluding from the list those which in ordinary operation accomplish only one of the six functions of year-round conditioning.

Also it seemed best in some cases to include units which are obviously for use during one season only. This applies to both summer equipments and winter equipments. Each group is persistently referred to as "air conditioning" by their makers. Including them lets you judge for yourself their relative position.

The list is alphabetical, and we have included the name and address of the maker in order that additional information may be secured direct.

The general plan in each case is to classify the product illustrated as to type, and to follow this by a short concise statement of the principal features. Additional similar products offered by the maker are sometimes briefly mentioned under "remarks".

Copy has in nearly every case had the benefit of review by sending it to the interested manufacturer with the request that he check it for accuracy of fact and statement. The response to this was most prompt, and we are glad to acknowledge the suggestions received and the universally helpful attitude adopted.

We believe that these pages will repay your careful reading, not only because of the information about the specific products and where you may obtain them, but also because it will show clearly the great variety of this equipment. The pages show an accurate cross-section of the kinds of equipment now to be had, and bring out very well how greatly ideas differ as to what constitutes equipment suitable for air conditioning small buildings.

A summary at the end of this section (page 67) brings out some of the points more fully.

Ace Humidifying Co., Minneapolis, Minn.

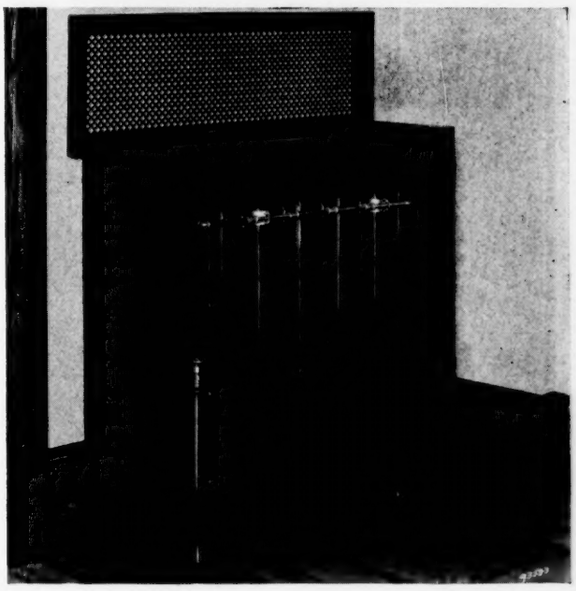
Type: Direct cabinet unit, replacing radiator for heating.

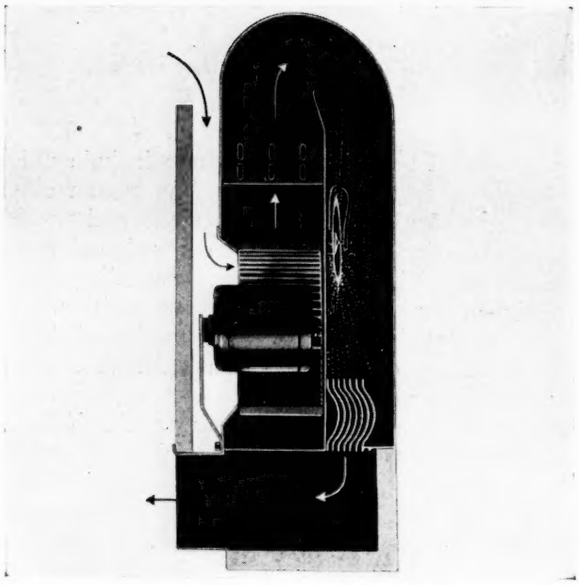
Includes: Heating radiator of special shape, humidifier, controls, all contained in a finished metal cabinet.

Fuel: Any.

Sizes and Capacities: Humidifiers numbered according to humidifier sections as: No. 2, two sections. Capacity, 2 gal. to 3 gal. per section on hot water job; 9 gal. per section on steam job.

Remarks: Unit intended to supply humidity necessary in a residence of small size. Adding sections permits increasing capacity. Humidification is by water passing over hot surfaces. Requires connection to electric and water lines and to heating piping.





Air-control Systems, Inc., Chicago, Ill.

Trade Name: Zephyr Air.

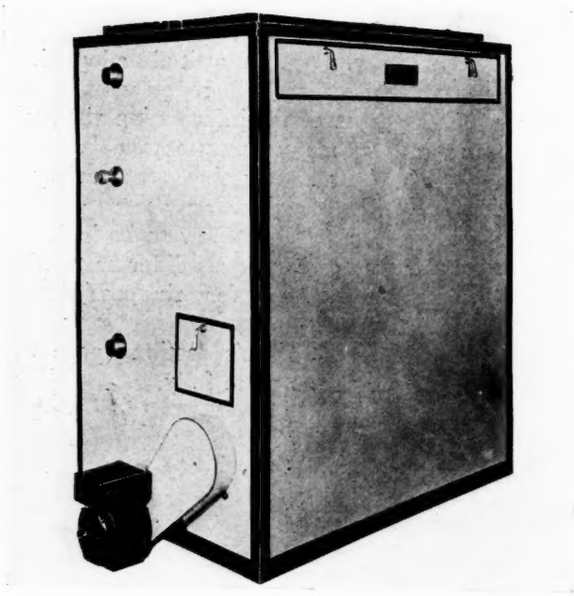
Type: Direct unit.

Includes: Washer unit with low pressure atomizer, fan, finned core for heating or cooling, cabinet enclosure when replacing radiator, ducts when installed in basement, ice storage system in which ice is alternately frozen and melted when cooling wanted only 8 hr. to 12 hr. per day.

Fuel: Any—replaces radiator for heating.

Sizes and Capacities: "Zephyr 75"—humidification and air washing, up to 40,000 cu. ft.; room heating, equivalent to 30 sq. ft. to 40 sq. ft.; cooling, one ton (12,000 B.t.u. per hr.), using one ton compressor for 24 hr. cooling or ½ ton with ice storage system.

Remarks: Requires connections to electric, water supply and waste, also heating and cooling pipe connections.



American Blower Corp., Detroit, Mich.

Trade Name: Sirocco Conditioner, Series O and R.

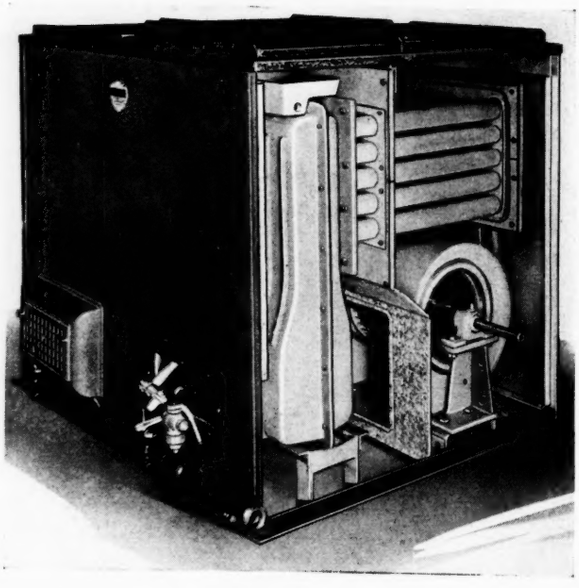
Type: Series R—indirect unit for basement installation. Series O—direct cabinet type unit.

Includes: Series R—enameled sheet metal jacket on angle iron frame enclosing centrifugal fans with canvas connections to casing, cloth bag type filters, two dry heating and cooling surfaces, humidifier, controls.

Fuel: Series R—any. Unit attached to any hot water heater.

Sizes and Capacities: Series R—four sizes for space from 14,500 to 50,000 cu. ft.

Remarks: Series R units combine advantages of warm-air heating with radiator heating. Series O units available in four sizes. Both units require connection to electric and water lines and to source of hot and cold circulating water. Series R also requires connection to circulating air ducts.



American Foundry & Furnace Co., Bloomington, Ill.

Trade Name: June-Aire, Model 130.

Type: Integral basement *warm-air* circulating unit.

Includes: Furnace, pan humidifier, filter, centrifugal fan, controls, insulated casing (individual or trunk ducts may be added).

Fuel: Gas.

Sizes and Capacities: Smallest size, 72,000 B.t.u. output; two, three and four section units available, each rated 72,000 B.t.u. per hr.

Remarks: Unit is compact, 23 in. wide, 41 in. deep and 40 in. high, enameled metal jacket. Fan driven by a belted motor, filter arranged for easy removal. Requires connection to electric, gas and water lines and to air circulating ducts. Separate fan-filter unit also offered.

American Machine Products Co., Marshalltown, Iowa.

Trade Name: Am-Pé-Co.

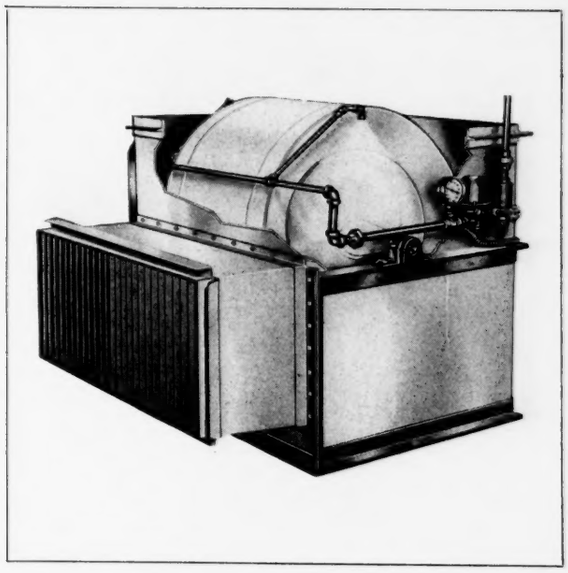
Type: Fabricated unit for use with *warm-air* and radiator plants.

Includes: Unit containing a blower and spray type washer together with eliminator plates all enclosed in one housing, controls, consisting of magnetic water valve, pressure regulator and strainer.

Fuel: None—(furnace not included with apparatus).

Sizes and Capacities: Thirteen sizes. Capacities range from 500 c.f.m. to 9620 c.f.m.

Remarks: Unit so arranged that spray water mixes with air entering fan. Air and water both pass through fan, excess water removed at eliminator plates. Requires connection to electric and water lines and to air circulating ducts.



American Radiator Co., New York, N. Y.

Trade Name: Ideal Cascade.

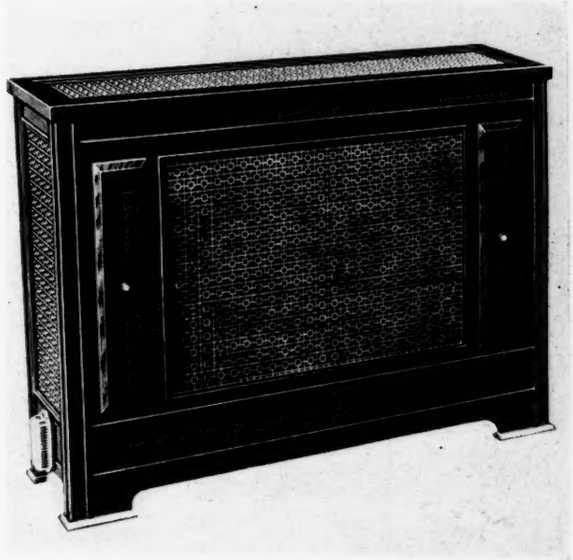
Type: Direct cabinet unit.

Includes: Heating radiator of special shape, humidifier, controls, all contained in a finished metal cabinet.

Fuel: Any—can be installed instead of a radiator for heating.

Sizes and Capacities: Two styles, one for use with steam and one for use primarily with hot water.

Remarks: Unit intended to supply humidity necessary in residences. May be installed recessed. Vitreous enamel finish on radiator surface. Humidification is by water passing successively over hot surfaces. Equipped with humidity control. Requires connection to electric and water lines and to heating piping.



Autovent Fan & Blower Co., Chicago, Ill.

Trade Name: Autovent.

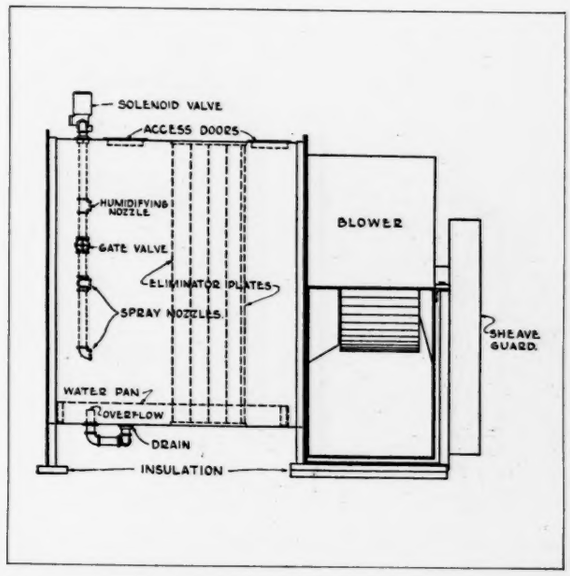
Type: Fabricated unit for use with *warm-air* plants.

Includes: One model with blower, filter, spray washer and eliminator plates; another model with foregoing together with additional spray nozzles and recirculating pump for cooling with iced water or city water.

Fuel: None (unit does not include furnace).

Sizes and Capacities: Domestic unit in three sizes with capacities from 1500 c.f.m. to 3500 c.f.m.; cooling unit in four sizes, capacities from 2500 c.f.m. to 7500 c.f.m.

Remarks: Requires connection to electric and water lines and air circulating ducts. Cooling unit in addition requires source of refrigerated water. Can also be used with radiator heating plants.



Betz Unit Air Cooler Co., Kansas City, Mo.

Trade Name: Unicool.

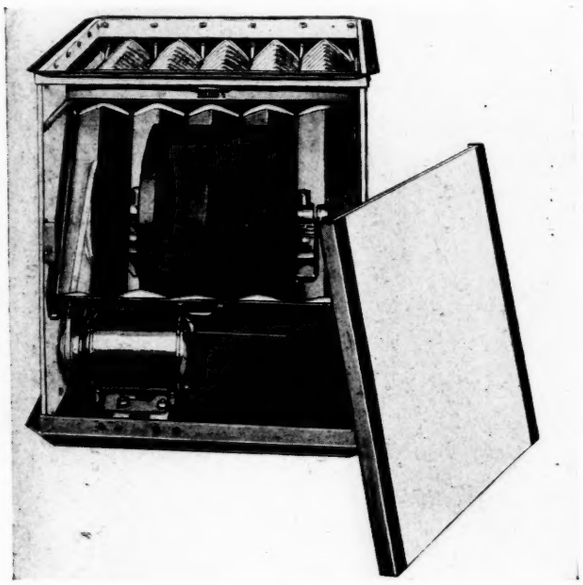
Type: Unit conditioner.

Includes: Complete system includes units and tank for the cooling water used in sprays, together with necessary pumps and controls. Units contain fan, sprays, eliminator and dry type heating surface.

Fuel: Any—heating coil connected to boiler.

Sizes and Capacities: Four sizes; 17,000 B.t.u. to 152,000 B.t.u. per hr.

Remarks: Sprays are used for both humidifying and dehumidifying. Dry fin type heater used for winter heating. Requires connection to electric and water lines and to heating and cooling circulation pipes. Maker also offers portable iced room cooler with electric heating element for winter. Ice capacity 450 lb.



The Bishop & Babcock Sales Co.,
Cleveland, Ohio.

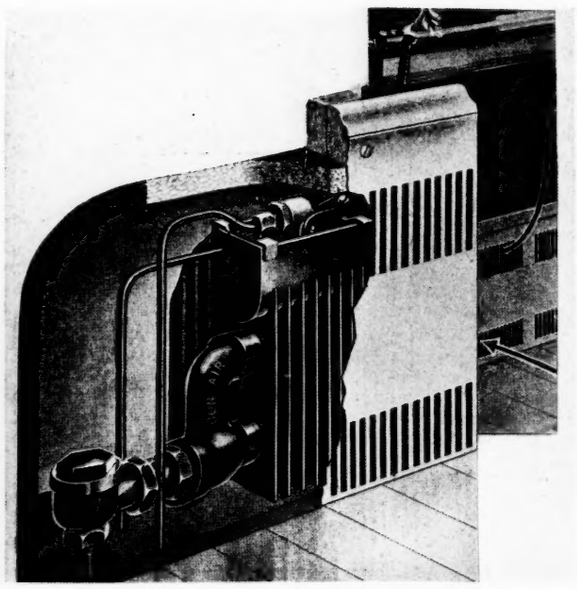
Type: Blower unit for use with *warm-air* plants.

Includes: Centrifugal fan with adjustable speed V-belt drive, multiple filter cells, and rubber-mounted motor, all included within a single insulated housing.

Fuel: None (unit does not include furnace).

Sizes and Capacities: Four sizes. Capacities adjustable up to the maximum. Maximum capacities 1,000, 2,000, 3,000, and 4,000 c.f.m.

Remarks: Entire equipment completely enclosed, and the casing is finished attractively in silver and black. Filter units easily removable, and speed is adjustable through the removable access panel at rear. Other furnace blower units available both with and without casings.



Bon-Air Radiator Corp., Boston, Mass.

Type: Recessed humidifying radiator.

Includes: Fin type heating radiator of special design into which is built a pan type humidifier, and installed in an insulated and grilled recess.

Fuel: Any—connects to steam or hot water system.

Sizes and Capacities: Any length from 3 ft. to 12 ft., with ratings from 15 sq. ft. to 65 sq. ft. Grille height 10¾ in. above finish floor.

Remarks: Water level in humidifier under automatic control. Radiation made to order. Can be installed in ready-built homes without disturbing wall construction. Grilles available in various finishes. Requires connection to water lines and to steam or hot water piping.

The Bryant Heater & Mfg. Co.,
Cleveland, Ohio.

Trade Name: Dualator.

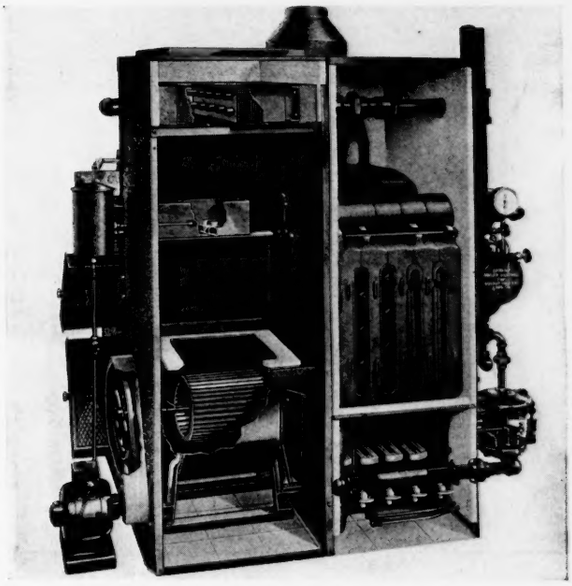
Type: Standard gas-fired boiler built integrally with fan, humidifier, filters and dry heating surface.

Includes: Cast iron boiler equipped with gas controls. In same casing but separate from boiler are a belt-driven centrifugal fan, steam type humidifier, filters and a fin type steam heated surface, connected to boiler header.

Fuel: Gas.

Sizes and Capacities: Three units, with total available B.t.u. per hour ranging from 211,200 to 316,800.

Remarks: Heated air passed through fan carried to heated space by ducts. At same time steam may be supplied to the usual radiator system. Requires connection to electric, gas and water lines, and to circulating air ducts and to radiator system.



Buffalo Forge Co., Buffalo, N. Y.

Type: Direct ceiling suspended cooling unit.

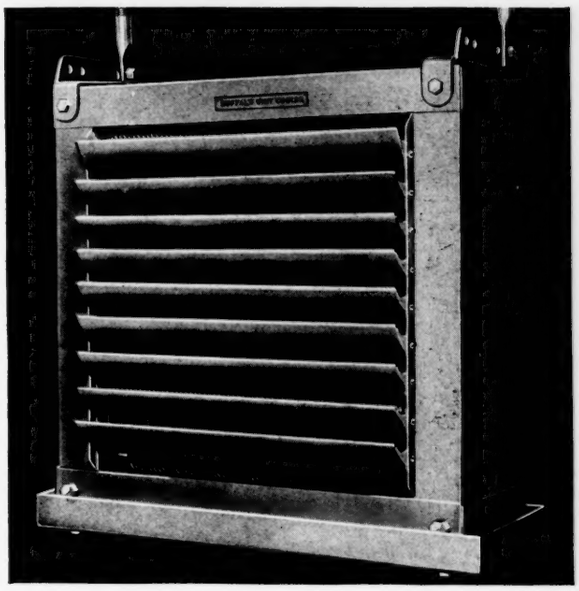
Includes: Finned type coil in front of propeller fan, horizontal vanes, drip pan, all enclosed in metal casing.

Fuel: None—independent of heating system. Refrigerant can be ammonia, brine or cold water.

Sizes and Capacities: Four sizes with air capacities ranging from 240 c.f.m. to 3280 c.f.m.

Remarks: Requires connection to cooling circulation and to electric lines.

Maker also offers full line of washers, etc., for large central installation. Also unit heaters, unit washers, unit humidifiers, and floor-mounted room coolers. Also a portable iced room cooler of 300 lb. capacity.



Campbell Metal Window Corp.,
New York, N. Y.

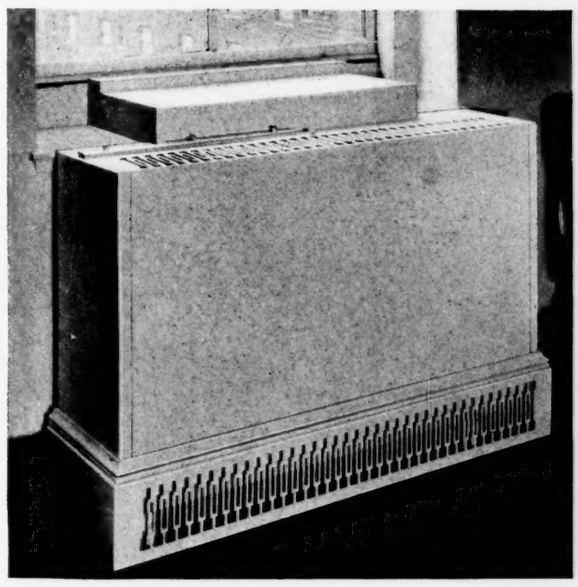
Type: Direct cabinet and recessed units.

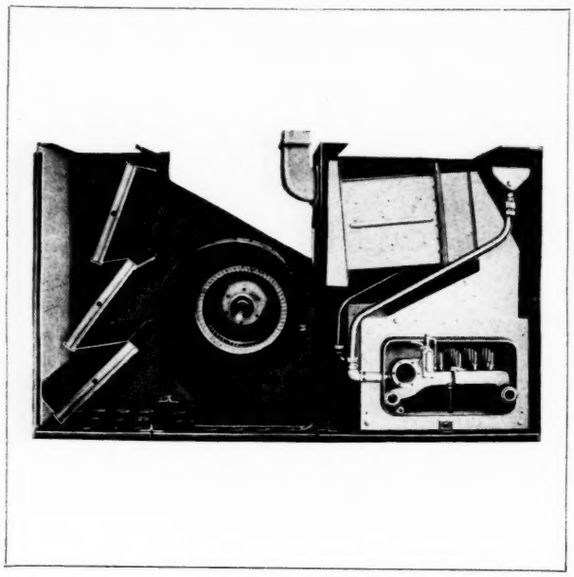
Includes: A series of six models each of which contains a silencer, filter and fan. Intended for use in and under windows, both new and old buildings. Various models accomplish different functions. No detailed list of apparatus in each cabinet available.

Fuel: Any—five of the units for connection to radiator systems.

Sizes and Capacities: No information.

Remarks: One model (A-1) can be equipped for humidification; another model (B) regularly equipped for humidification; a third model (C) intended for heating, cooling, humidification and dehumidification. Requires connection to electric and water lines and to heating and cooling circulation piping.





Carrier-Lyle Corp., Newark, N. J.

Trade Name: Weathermaker.

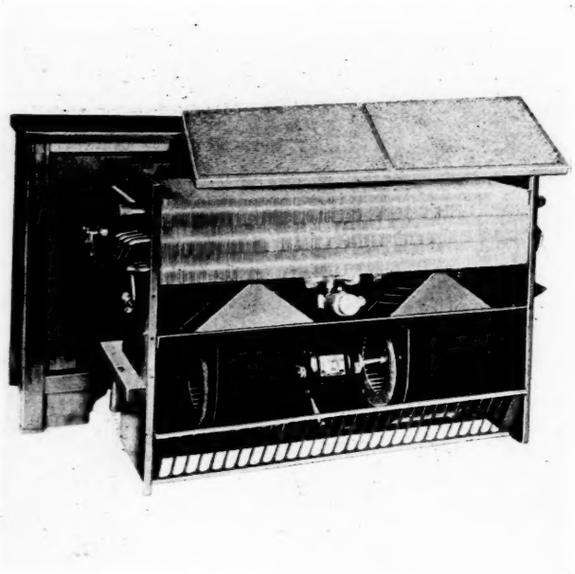
Type: Integral basement *warm-air* circulating unit.

Includes: Furnace, pan humidifier, filters, centrifugal fan, insulated casing, controls, humidifier of distinctive type, casing around motor and drive.

Fuel: Gas.

Sizes and Capacities: Five sizes, with hourly B.t.u. output ranging from 100,000 to 300,000.

Remarks: Jacket of enameled metal with metal trim, filters arranged for easy cleaning, belted motor drive for fan; controls grouped on one side of unit. Requires connection to electric, gas and water lines and to air circulating ducts. A feature is engineering service available with unit. Maker also offers humidifier cabinets intended for either direct or indirect installation.



Carrier-York Corp., Newark, N. J.

Trade Name: Atmospheric cabinet.

Type: Direct cabinet unit for installation under windows.

Includes: Centrifugal fan and dry fin heating element, humidifier, controls, filter. Separate coil for cooling.

Fuel: Any—units attached to steam or hot water systems.

Sizes and Capacities: 300 c.f.m.

Remarks: Maker also offers a portable ice cooling cabinet in which fan blows air over ice resting on metal grid. Capacity 300 lb.

Chicago Pump Co., Chicago, Ill.

Trade Name: Northern-Breeze.

Type: Portable iced room cooler.

Includes: Fan, motor and circulating pump assembly, dry extended surface cooling coil, ice chamber, insulated casing on casters.

Sizes and Capacities: Two sizes, one 300 lb. ice, the other one-third smaller.

Remarks: Cool air discharged toward ceiling. Special control. Can be used as humidifier in winter. Requires electric connection.

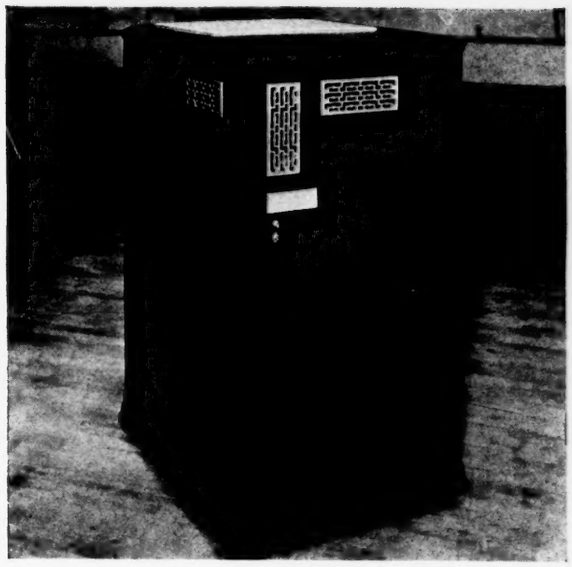
ChilAire Corp., Kansas City, Mo.

Type: Portable iced room cooler.

Includes: Centrifugal fan, centrifugal pump, dry extended surface cooling coil, ice chamber, insulated casing on casters.

Sizes and Capacities: 250 lb. ice capacity and 400 c.f.m.

Remarks: Ozonator installed as optional equipment. Horizontal discharge of chilled air. Ice chamber may be emptied by power pump. Requires connection to electric line.



Clarage Fan Co., Kalamazoo, Mich.

Series: 118 and 130, 218 and 230.

Type: Indirect unit.

Includes: Sprays, reheater, spray water heater, backward curved bladed fans, centrifugal pump, interior parts in sheet metal casing.

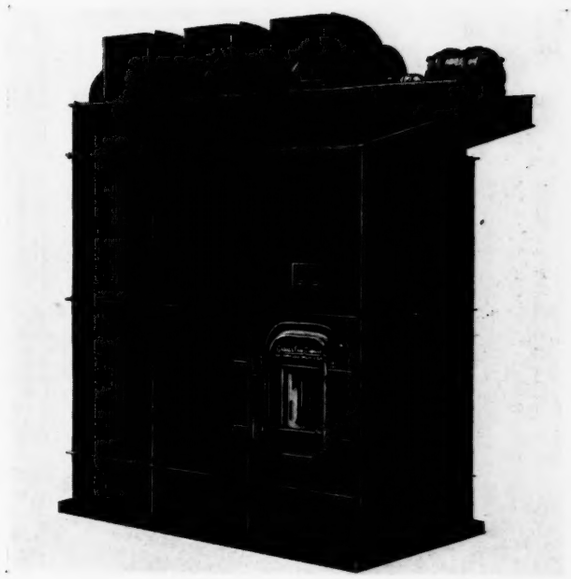
Fuel: Any—can be connected to steam or hot water system.

Sizes and Capacities: Six sizes in each of the two series; capacities from 765 c.f.m. to 11,400 c.f.m.

Remarks: Used as either indirect or direct units. Require connections to electric, water and drain lines, heating and cooling circulating piping, and to ducts if used indirect.

Series 118 and 130 primarily for humidifying; Series 218 and 230 for dehumidifying or heavy duty humidifying.

Electric or pneumatic temperature and humidity control available.



Conditioned Air Corp., Detroit, Mich.

Trade Name: Airco.

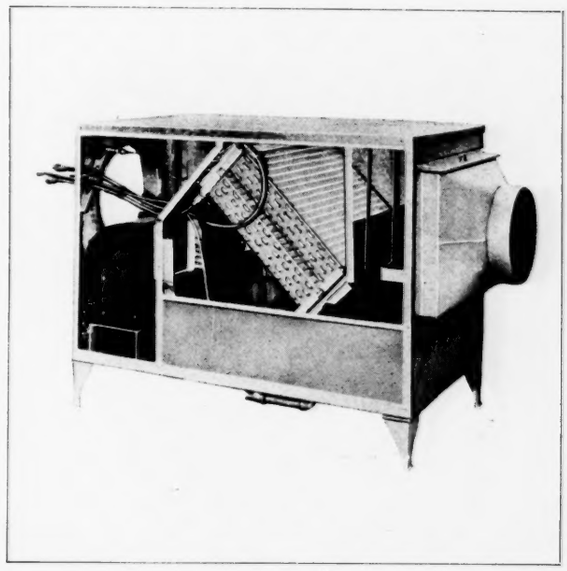
Type: Indirect unit for basement installation, particularly for residences, stores, etc.

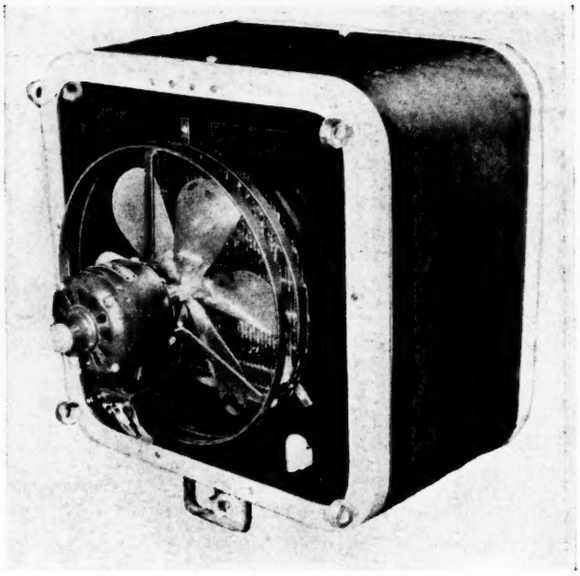
Includes: Centrifugal fan, humidifying radiator, direct expansion refrigerating coil, water sprays, dry filter, controls, all enclosed in sheet metal casing.

Fuel: Any—units attached to any steam boiler.

Sizes and Capacities: Two sizes, one of which offsets 36,000 B.t.u. per hr., moves 1500 c.f.m., uses 9 gal. of water per hour, and has a humidifying capacity up to 150,000 cu. ft. The other offsets 12,000 B.t.u. per hr., moves 900 c.f.m., same water capacity through sprays, and same humidifying capacity.

Remarks: Requires connection to electric and water lines, to air circulating ducts, and to heating and cooling circulation piping. Maker also offers a direct cabinet unit.





Copeland Sales Co., Mount Clemens, Mich.

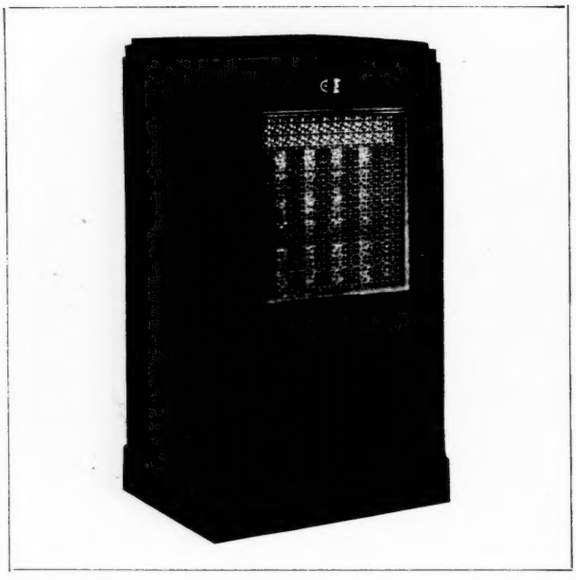
Type: Direct unit for wall mounting.

Includes: Non-ferrous heat exchange surface in front of a direct-driven propeller fan, lacquered aluminum casing for direct use in rooms.

Fuel: Any. For use in cooling.

Sizes and Capacities: One size, cools 3000 cu. ft. to 5000 cu. ft. of air approximately 15° when operated with 1 hp. water-cooled condenser.

Remarks: Units are compact and light in weight. Maker features them for use with refrigeration plant for cooling. Requires connection to electric lines and to cooling medium.



The Corozone Co., Cleveland, Ohio.

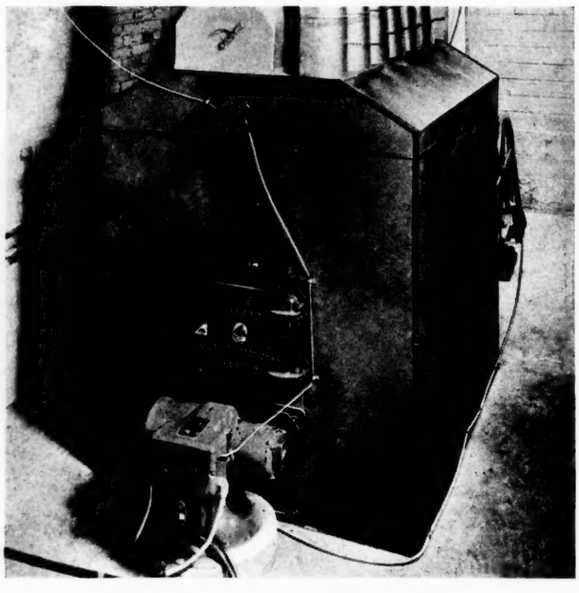
Trade Name: De Luxe Aquazone.

Type: Portable room cooler and conditioner; uses ice.

Includes: Wheels driven by fan pressure, dry extended surface cooling coil, ice chamber enclosed in finished metal casing and mounted on casters.

Sizes and Capacities: 750 c.f.m.

Remarks: Corozone units optional. Can be used as humidifier in winter. Requires connection to electric lines.



Dail Steel Products Co., Lansing, Mich.

Trade Name: Dailaire.

Type: Integral basement *warm-air* circulating unit.

Includes: Furnace, spray type humidifier, air washer and filters located on each side of casing, belted motor-driven centrifugal fan, blower and washer controls, metal casing enclosing fan.

Fuel: Gas, oil or stoker-fired coal.

Sizes and Capacities: Seven sizes, with hourly B.t.u. output ranging from 115,000 to 784,000.

Remarks: Unit adaptable for use with either oil burner, coal stoker, or gas fuel. Fan mounted at top of unit, operates as a draw-through arrangement. Unit so designed that either rectangular trunks or round pipes can be used for distribution. Requires connection to electric and water lines and to air circulating ducts. Maker also offers conditioners for use with steam or hot water systems.

C. A. Dunham Co., Chicago, Ill.

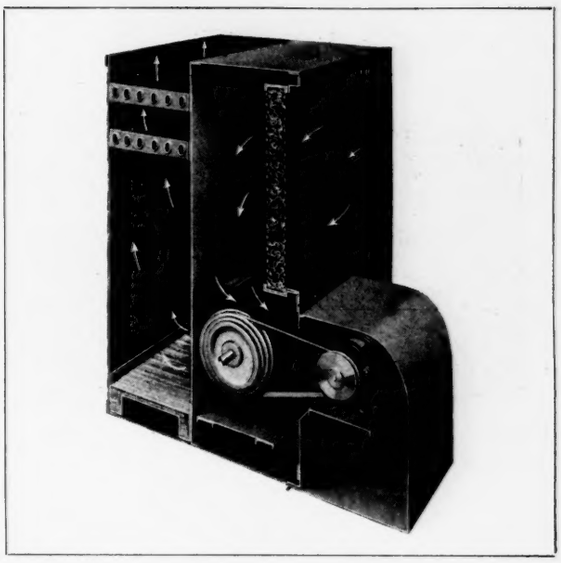
Type: Indirect unit for basement installation.

Includes: Belt-driven centrifugal fan with speed selection, filter, two extended surface heat exchangers, controls, enclosed in a sheet metal casing.

Fuel: Any (see remarks below about use with gas).

Sizes and Capacities: No information.

Remarks: Unit is separate and can be used in connection with steam systems, but is particularly adapted for use with a special gas-fired system other parts of which are also offered by the maker. When so used this unit makes use of a mixture of combustion products and vapor in its heating coils. May be used for cooling by connecting to cold water circulation. Requires connection to electric and water lines, to heating or cooling medium, and to circulating air ducts.



Economy Baler Co., Ann Arbor, Mich.

Trade Name: HealthAir.

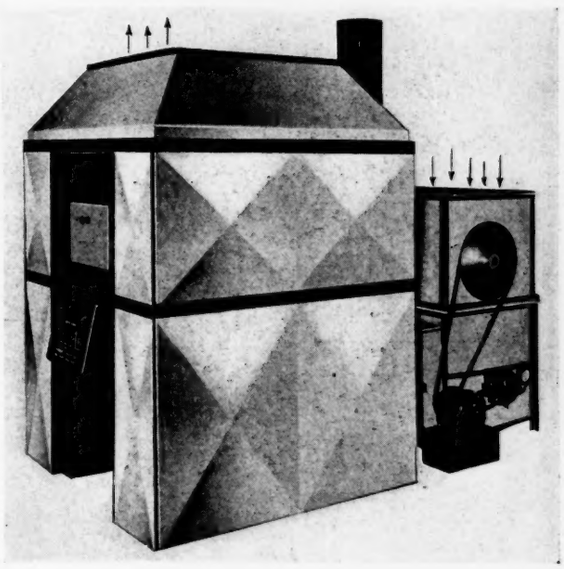
Type: One-unit-to-be-added basement *warm-air* circulating unit.

Includes: Furnace, motor-driven centrifugal fan and spray type washer with eliminator, built as a unit located alongside furnace casing, controls, rectangular metal casing.

Fuel: Gas or oil.

Sizes and Capacities: Seven sizes, with capacities ranging from 500 c.f.m. to 4500 c.f.m.

Remarks: Enameled metal casing, design of washer a distinctive feature with air blown against the spray. Requires connection to electric and water lines and to air circulating ducts. Conditioning unit also offered separate from furnace for use with steam or hot water systems or with existing warm-air furnace plants.



The Edwards Mfg. Co., Cincinnati, Ohio.

Trade Name: Hot-Kold.

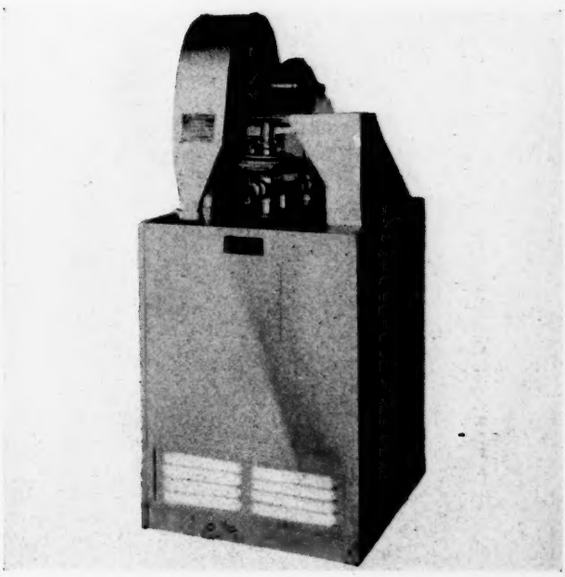
Type: Integral basement *warm-air* circulating unit.

Includes: Furnace, centrifugal fan, humidifier, insulated casing, controls, and air filter.

Fuel: Gas.

Sizes and Capacities: Two sizes, one with input capacity of 94,000 B.t.u. per hr., the other with 155,000 B.t.u. per hr.

Remarks: Unit is compact with fan mounted at top or side; has a distinctive type of humidification; uses chromium steel between hot gases and air. Requires connection to electric and gas lines and to air circulating ducts.



The Emerson Electric Mfg. Co.,
St. Louis, Mo.

Type: Fabricated unit for use with *warm-air* furnace.

Includes: A blower unit and a washer unit. Blower unit is direct motor driven, variable speed, double centrifugal blower built into a sheet metal housing. The washer unit contains spray nozzles, eliminator plates, and controls. The two casings nest together as illustrated, or blower can be installed alone.

Fuel: None (furnace not included with apparatus).

Sizes and Capacities: Three sizes, with air deliveries ranging from 450 c.f.m. to 4,400 c.f.m. through the washer.

Remarks: Intended for attaching to warm-air furnaces. Require connection to electric and water lines and to air circulating ducts. Maker also offers portable humidifying unit.

Erskine Copper Radiator Corp.,
New York, N. Y.

Trade Name: Thermoist.

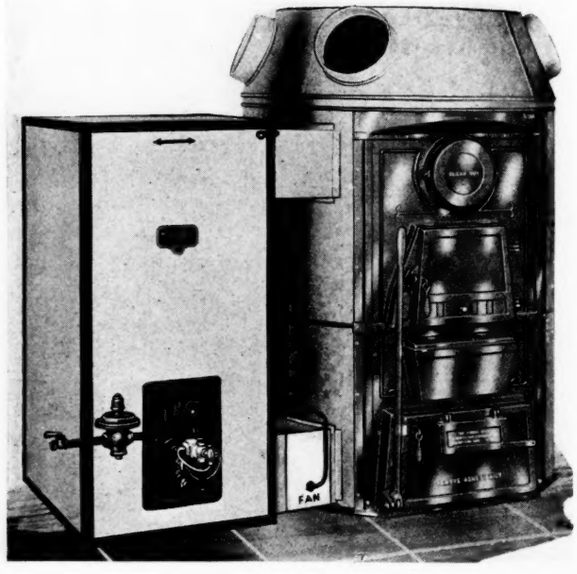
Type: Direct free standing, for residence work especially.

Includes: Fin type heating surface and humidifier enclosed in finished metal cabinet, fully automatic.

Fuel: Any—can be attached to steam or hot water system.

Sizes and Capacities: 11 sizes with heating capacities ranging from 17 sq. ft. to 60 sq. ft. and humidifying capacity from 3,600 cu. ft. to 18,200 cu. ft.

Remarks: Maker also offers a floor type unit.



The Forest City Foundries Co.,
Cleveland, Ohio.

Trade Name: Niagara 110.

Type: Integral basement *warm-air* circulating unit.

Includes: Furnace, pan humidifier, filter, centrifugal fan, controls, insulated casing, can operate by gravity, air washer if desired.

Fuel: Gas.

Sizes and Capacities: Five sizes are listed with input ratings from 90,000 B.t.u. to 220,000 B.t.u. per hr.

Remarks: Crystalline metal casing. A distinctive feature is that when direct-connected blowers are used, the blowers, motor and air filter are mounted in a drawer-like compartment which can be withdrawn, giving easy access. Requires connection to electric, water and gas lines and to air circulating ducts.

The Fox Furnace Co., Elyria, Ohio.

Trade Name: Sunbeam, Series No. 10.

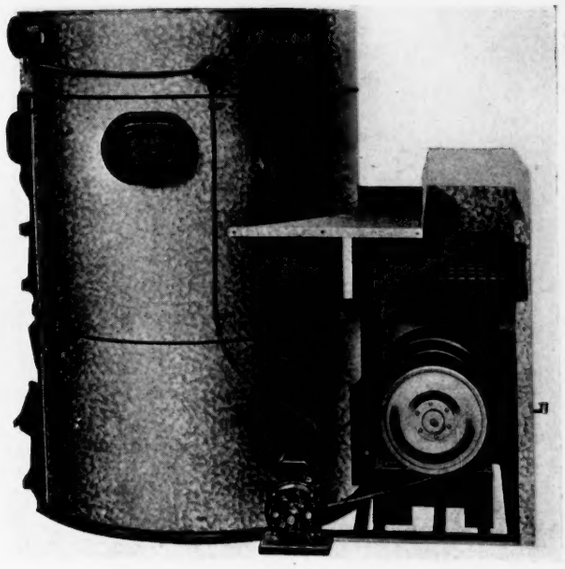
Type: Integral basement *warm-air* circulating unit.

Includes: Furnace, drip humidifier, centrifugal belt-driven fan, controls, filters.

Fuel: Coal—convertible to oil or gas.

Sizes and Capacities: Five sizes, capacities ranging from 80,000 B.t.u. to 157,000 B.t.u. per hr. at register.

Remarks: Maker also offers a gas-designed unit equipped with auxiliaries and controls for winter air conditioning; also oil and coal-burning unit with boiler plate heating element, known as Series No. 60 Sunbeam air conditioning unit.



Frigidaire Corp., Dayton, Ohio.

Type: Direct cabinet unit.

Includes: Centrifugal fan, fin heating coil, fin cooling coil, humidifier, controls, built into a metal cabinet.

Fuel: Any—can be connected to steam, vapor or hot water systems.

Sizes and Capacities: Various models handle up to 585 c.f.m.

Remarks: Maker offers a number of styles and models, including floor cabinets, recessed, wall mounting, and units in which the refrigeration machinery is contained. Most units intended for remote location of refrigeration machinery. Units may be used for cooling and dehumidifying without heating and humidification, and some models are intended for this use only. Requires connection to electric and water lines and to heating circulation piping.

Green Foundry & Furnace Works, Des Moines, Iowa.

Trade Name: Colonial.

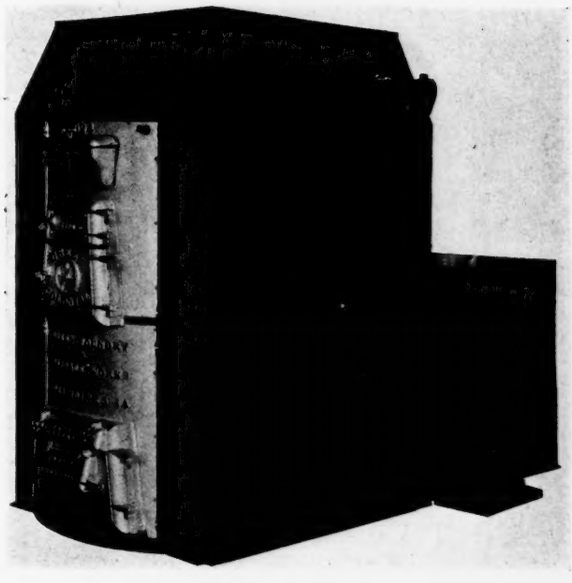
Type: One-unit-to-be-added basement *warm-air* circulating unit.

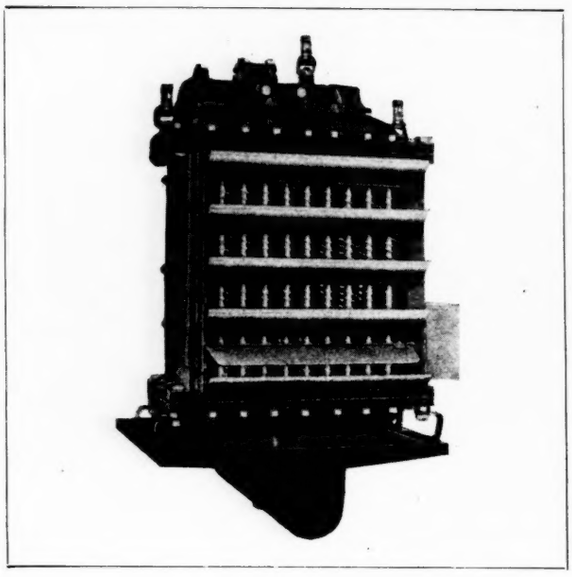
Includes: Furnace, pan humidifier, belt-driven centrifugal fan, filter, controls, metal casing, automatic louvers if desired, fan and filter are built into separate metal-covered casing which connects to bottom of furnace casing.

Fuel: Coal—convertible to oil or gas.

Sizes and Capacities: Seven sizes, 75,000 B.t.u. to 300,000 B.t.u. per hr. capacities. Fan units from 950 c.f.m. to 5040 c.f.m. depending on number of filters used and on fan speed.

Remarks: Jointless connection to prevent gas leaks, fan-and-filter unit casing sound-proofed, canvas connection between fan-and-filter unit and furnace casing. Requires connection to electric and water lines and to air circulating ducts.





Grinnell Co., Providence, R. I.

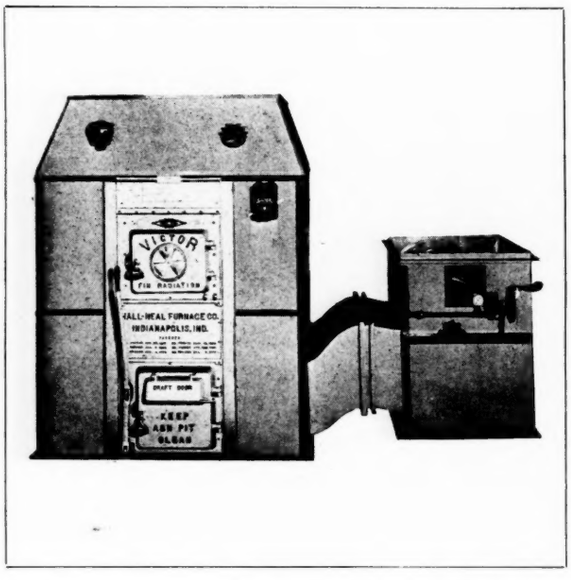
Type: Direct suspended unit cooler.

Includes: Extended surface seamless steel heat exchange surface in front of direct-driven propeller fan, multi-speed motor, alloy housing, and adjustable louvers.

Fuel: None. Unit is not primarily designed for connection to heating systems. Refrigerant, ammonia, brine or cold water.

Sizes and Capacities: Two models, one a standard unit, the other a close fin unit for use where the refrigerant temperature is above 26° F. Capacities vary with the temperature differential and with motor speed.

Remarks: Maker features the liquid level control and automatic defroster. Former automatically maintains constant level of refrigerant in cooler. Defroster is also automatic. Maker also supplies unit heaters.



Hall-Neal Furnace Co., Indianapolis, Ind.

Trade Name: Victor-Aire.

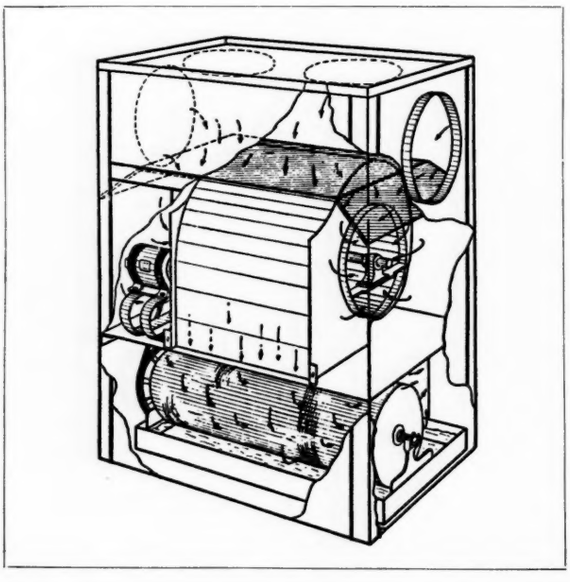
Type: One-unit-to-be-added basement *warm-air* circulating unit.

Includes: Furnace and humidifier and a unit to be added containing centrifugal blower and washer. Fan-and-washer unit connects to bottom of furnace casing.

Fuel: Coal—convertible to oil or gas.

Sizes and Capacities: Up to 300,000 B.t.u. per hr.

Remarks: Maker states that his practice is to figure each job separately and divide the unit to care for each particular job. Requires connection to electric and water lines and to air circulating ducts. Baffle plates of special fin construction, a distinctive feature.



Hess Warming & Ventilating Co., Chicago, Ill.

Type: Fabricated unit for use with *warm-air* plant.

Includes: Humidifier, which consists of a wire mesh cylinder dipping in a water reservoir, centrifugal blower, filter and washer, all enclosed in a metal casing, controls.

Fuel: Any (unit does not include furnace).

Sizes and Capacities: Two sizes of conditioner units—one for use in houses up to 20,000 cu. ft., and one for not over 35,000 cu. ft.

Remarks: Construction of conditioner unit with wire mesh cylinder a distinctive feature. Requires connection to electric and water lines and to air circulating ducts, fuel connection as required. Conditioners available as separate units for attaching to existing warm-air furnaces. Units may also be used in conjunction with steam or hot water:

Holland Furnace Co., Holland, Mich.

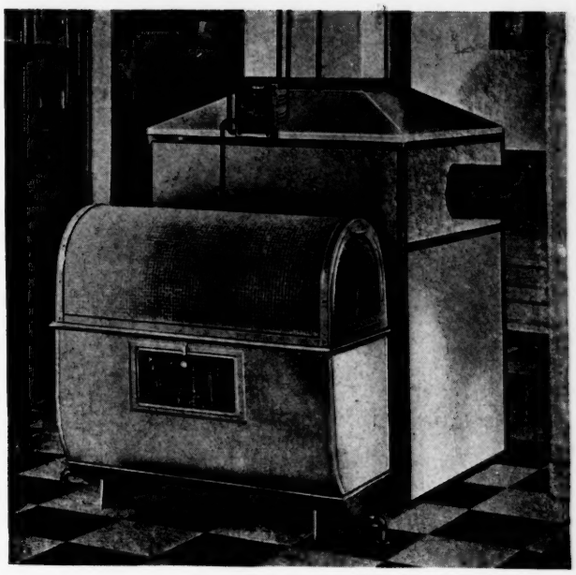
Type: Fabricated unit for use with *warm-air* plants.

Includes: Metal casing containing copper mesh filter, centrifugal fans, air washer and eliminator, controls, spray type humidifier.

Fuel: None. Unit does not include furnace.

Sizes and Capacities: One size conditioner unit for connection to furnaces of various sizes; variable speeds.

Remarks: Arrangement may be made for passing refrigerated water through spray nozzles, requiring refrigerating unit. Requires connection to electric and water lines and to air circulating ducts. Unit available separately for attaching to existing warm-air furnaces or to steam or hot water systems. Maker also offers warm-air furnaces, separately or with unit.



Ilg Electric Ventilating Co., Chicago, Ill.

Trade Name: Ilg-Kold.

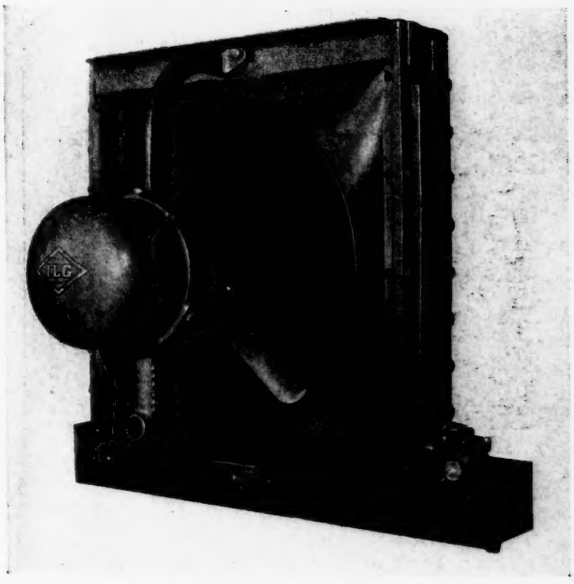
Type: Direct unit for wall or ceiling mounting.

Includes: Heat exchange surface in front of a direct-driven propeller fan, finished casing and deflectors.

Fuel: Any—units can be connected to hot water systems directly or with converter to steam system. Cooling by direct expansion or cooled water.

Sizes and Capacities: Three sizes, 600 c.f.m. to 1800 c.f.m.

Remarks: Unit featured for cooling installations but can be adapted for heating. Recessed installations can also be made. Maker also offers direct cabinet type unit and a portable iced room cooler, which uses propeller fan and delivers 500 c.f.m., 300 lb. ice capacity.



H. S. Kaiser Co., Chicago, Ill.

Trade Name: Kaiseraire.

Type: Portable iced room cooler.

Includes: Fan, filter, vapor humidifying system, extended surface dry cooling, finished casing mounted on casters.

Sizes and Capacities: Two sizes, one 300 lb. ice and 350 c.f.m.; the other 500 lb. ice and 500 c.f.m.

Remarks: Maker also offers portable room cooler, holding 200 lb. ice, cooling only. Requires connection to electric lines.

The Kelsey Heating Co., Syracuse, N. Y.

Trade Name: ConditionAire.

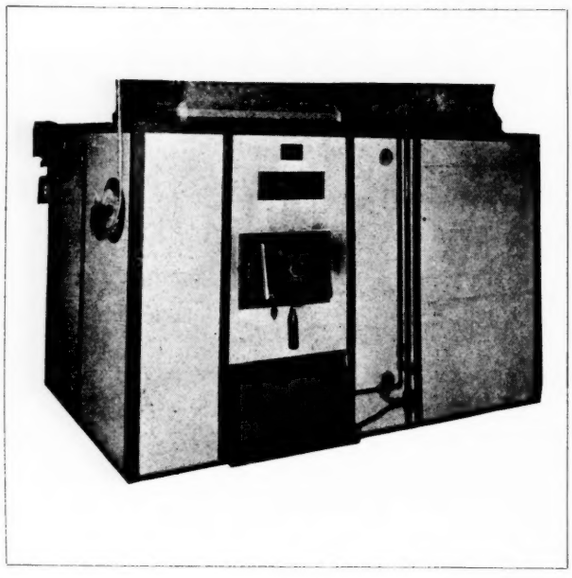
Type: Two-units-to-be-added basement *warm-air* circulating unit.

Includes: Furnace with drip and pan type humidifier, controls, air washer unit or a filtering unit, and a centrifugal fan unit. Units to be added are so arranged that they nest together and connect to the bottom of the furnace casing.

Fuel: Gas—but units may be added to coal or oil furnaces.

Sizes and Capacities: Four sizes, B.t.u. per hour capacities from 180,000 to 320,000.

Remarks: Fiber air filter used when outside air is passed through the furnace, but may be used as well as the spray washer with recirculated air. Air filter is of exclusive construction and is a feature of this device.



Kruse Co., Indianapolis, Ind.

Trade Name: Krusair.

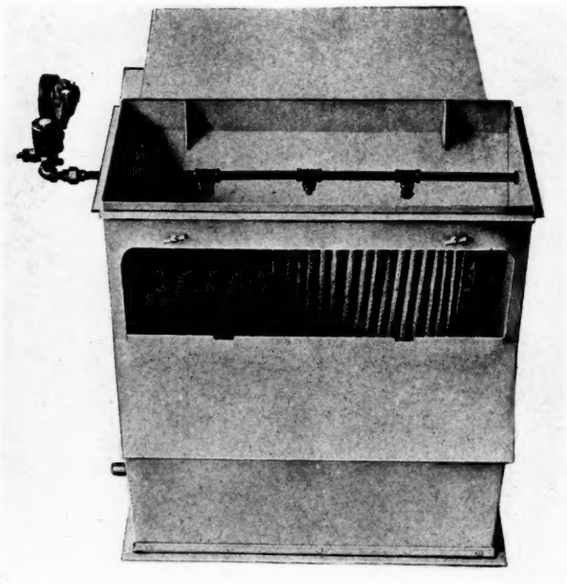
Type: Integral basement *warm-air* circulating unit.

Includes: Filters, blower, washer, automatic humidifier and by-pass damper, furnace for oil or gas, insulated metal casing, automatic controls on blower and humidifier.

Fuel: Oil or gas.

Sizes and Capacities: Four sizes, output B.t.u. per hour capacities ranging from 120,000 to 324,000.

Remarks: Filters arranged for easy removal at front of unit for cleaning, both return and delivered air connections are at top of unit. Requires connection to electric and water lines and air circulating ducts.



Lakeside Co., Hermansville, Mich.

Trade Name: Furblo Fairweather.

Type: Fabricated unit for use with *warm-air* plant.

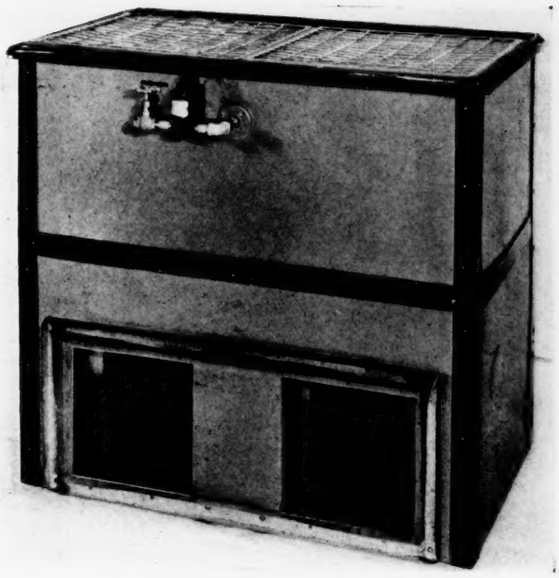
Includes: Air filters, centrifugal blower, controls, washer humidifier.

Fuel: None (unit does not include furnace).

Sizes and Capacities: Five sizes, capacities up to 7500 c.f.m.

Remarks: Washer under solenoid valve control; sprays located at top directed toward filter. Filter acts as an eliminator. Requires connection to electric and water lines and to air circulation. Maker also offers Furblo, a design consisting of three nesting units, and other types of filters, washers and humidifiers.

Lau Heating Service, Inc., Dayton, Ohio.



Type: Fabricated unit for use with *warm-air* plant.

Includes: A unit built in one casing and containing centrifugal fan, washer, and filter units.

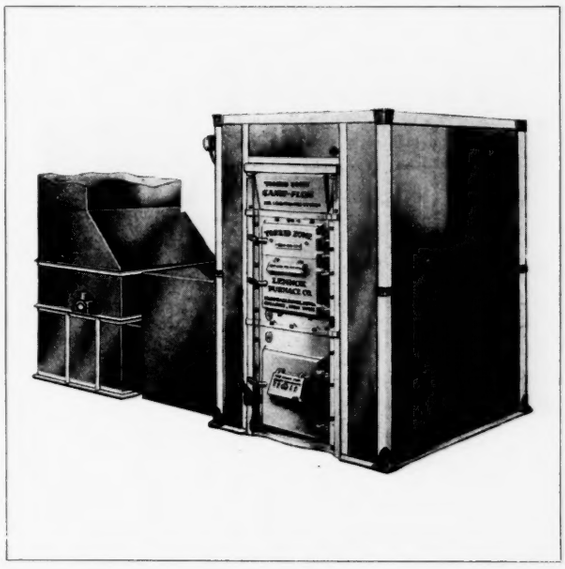
Fuel: None (unit does not include furnace).

Sizes and Capacities: Unit handles from 715 c.f.m. to 1110 c.f.m., depending on the motor speed and duct static.

Remarks: Maker also offers a fan-and-filter unit and an air conditioner built up of two units, which permit air capacities up to 5000 c.f.m. Units so designed that they can be used with basement or return air. Requires connection to electric and water lines and to air circulating ducts.

Lennox Furnace Co., Inc., Syracuse, N. Y.

Trade Name: Torrid Zone Aire-Flo.



Type: Two-units-to-be-added basement *warm-air* circulating unit.

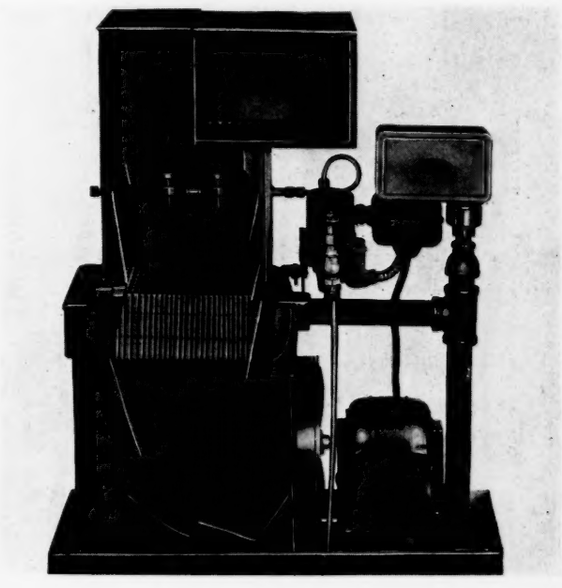
Includes: Furnace to fit fuel desired, air washer unit or a filtering unit and a centrifugal fan unit, controls. Units arranged to connect to the bottom of furnace casing.

Fuel: Any—manufacturer makes coal, oil and gas-fired furnaces, all arranged for adding conditioning units to any of them.

Sizes and Capacities: In general, range of output capacities is from 80,000 B.t.u. to 180,000 B.t.u. per hr. A larger model is available from 200,000 B.t.u. to 270,000 B.t.u. per hr.

Remarks: Either washer unit or filter unit may be used as desired. Requires connection to electric and water lines and to air circulating ducts.

Lewis Air Conditioners, Inc.,
Minneapolis, Minn.



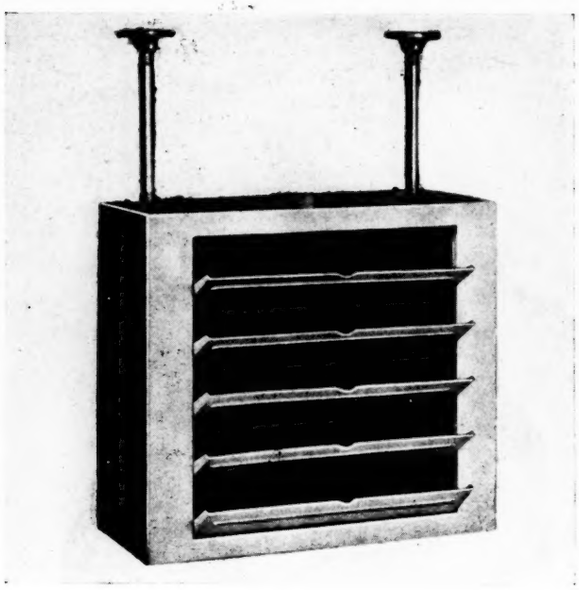
Type: Model M-2 for direct room cabinet or basement installation.

Includes: Direct-driven propeller fan, controls, spray nozzle, fin type coil, eliminator, enclosed in finished metal cabinet.

Fuel: Any—used with steam or water systems.

Sizes and Capacities: One unit has capacity for 10-12 room home.

Remarks: Maker also offers Model M-3, larger capacity, provides year 'round air circulation, humidification, air filtration. M-3 incorporates cooling circulation piping. Offers portable room cooler in which ice melts submerged, water pumped dry surface and return ice melt tank; 400 c.f.m., 300 lb. ice capacity. Also, direct cabinet cooler.



McCord Radiator & Mfg. Co., Detroit, Mich.

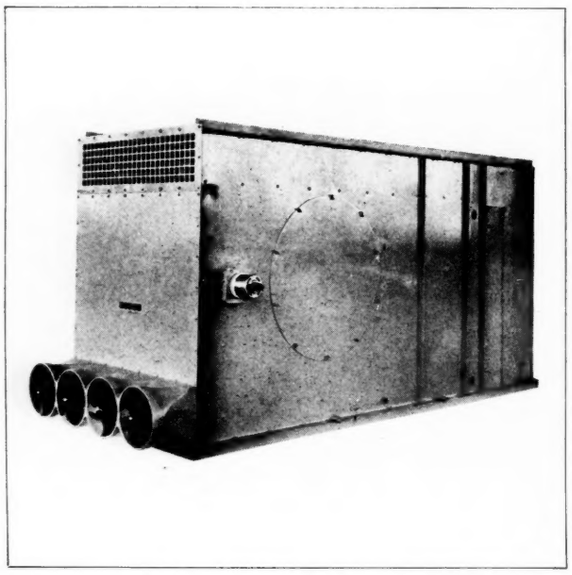
Type: Direct unit for wall or ceiling mounting.

Includes: Finned copper heat exchange surface in front of a direct-driven propeller fan, finished casing and deflectors.

Fuel: Any—unit can be connected to steam or hot water system directly or with converter to steam system. Cooling by circulation of water cooled by any means.

Sizes and Capacities: One size, capacity varied by 3-speed fan.

Remarks: Unit featured for cooling installations but can be adapted for heating.



J. H. McCormick & Co., Williamsport, Pa.

Trade Name: Airtrol.

Type: Cabinet unit.

Includes: Distinctive impeller type of fan, fin tube coil, distinctive rifled delivery nozzles, automatic or manual controls optional.

Fuel: Any—can be attached to any steam system.

Sizes and Capacities: 22 models, air volume ranging from 1600 c.f.m. to 4000 c.f.m.

Remarks: Unit can be installed in room to be conditioned or remote (indirect), depending on conditions, and may be used with mechanical refrigeration for direct expansion application or with refrigerated water. Humidity control optional. Requires connection to electric and water lines, to heating and (or) cooling circulation piping, and to air circulating ducts when used remote. Has electric elements for tempering air before boilers are started.

The Meyer Furnace Co., Peoria, Ill.

Trade Name: Weir Conditioned-air Unit.

Type: One-unit-to-be-added basement *warm-air* circulating unit.

Includes: Furnace with rectangular casing, a fan-and-filter unit designed to fasten to the furnace casing near the bottom, controls, pan humidifier, motor-driven centrifugal fan.

Fuel: Coal—convertible to oil or gas.

Sizes and Capacities: Seven sizes are listed with output B.t.u. per hour ratings ranging from 92,000 to 316,000.

Remarks: Casing has double wall with baked enamel finish, controls include blower control, room temperature and bonnet limit. Requires connection to electric and water lines and to air circulating ducts.

Minneapolis Air Conditioner Co.,
Minneapolis, Minn.

Trade Name: Tropico.

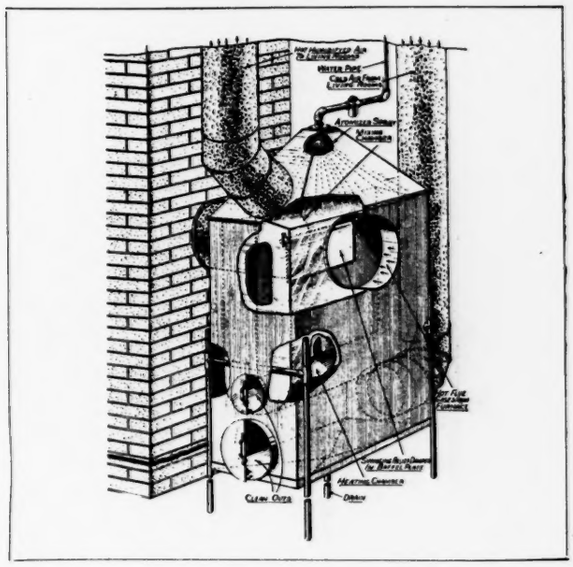
Type: Basement unit, particularly for residence work.

Includes: Spray head, controls, copper-bearing surface located inside sheet metal casing. Centrifugal fan mounted below casing and connected to air circulation.

Fuel: Any—can be connected to flue or warm-air furnace or boiler.

Sizes and Capacities: No information.

Remarks: Unit designed to extract heat for humidification from flue gases. Ducts lead from unit to heated rooms. Requires connection to water and electric lines, to flue, and to air circulation. Maker also offers other models operating on same principle.



Modine Manufacturing Co., Racine, Wis.

Trade Name: Ice-Fan.

Type: Portable iced room cooler.

Includes: Monitor top with fan and motor, intermediate sections serving as ice containers, and base.

Sizes and Capacities: Three sizes, providing 75 lb., 150 lb. and 225 lb. of ice capacity, respectively. Two finishes, walnut and white; also prime coated.

Remarks: Different sizes are built up by adding units, the top section and base remain the same. Sectional idea a distinctive feature. Top can be rotated to control direction of horizontal air flow; adjustable deflector directs air stream vertically. Requires connection to electric line. Base acts as reservoir for moisture extracted from air.

Montag Stove & Furnace Works,
Portland, Ore.

Trade Name: Montag-Air.

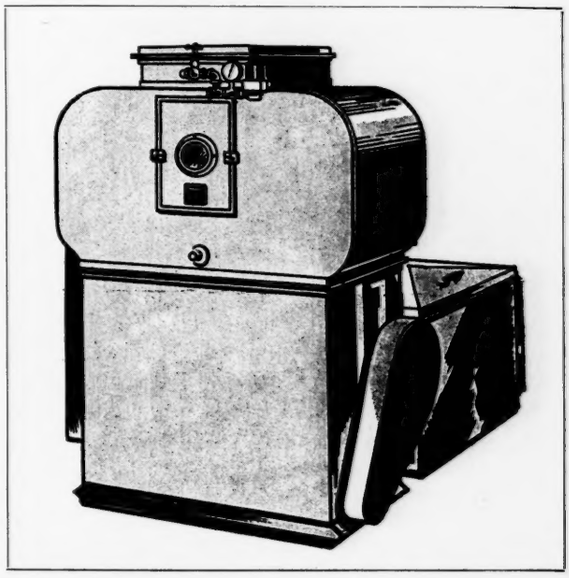
Type: Fabricated unit for use with *warm-air* plants.

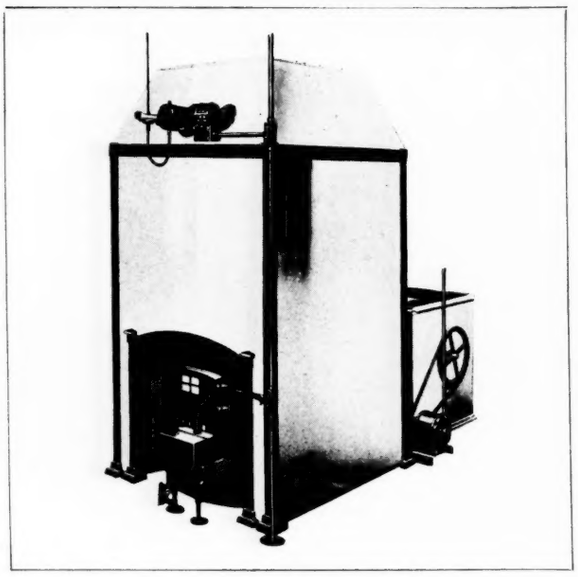
Includes: Three units nested for adding to warm-air furnace; one unit contains centrifugal fan, one filter, and one washer.

Fuel: None (unit does not include furnace).

Sizes and Capacities: Fan units with capacities ranging from 47,500 B.t.u. to 410,000 B.t.u. per hr. (at 70° temperature change). Three sizes of washer and three sizes of filter units.

Remarks: Filters are of dry type, filter unit placed between fan and heater; washer of spray type under automatic control. Unit designed especially for the northwest. Requires connection to electric and water lines and to air circulating ducts.





Motor Wheel Corp., Lansing, Mich.

Trade Name: MW Weather Control.

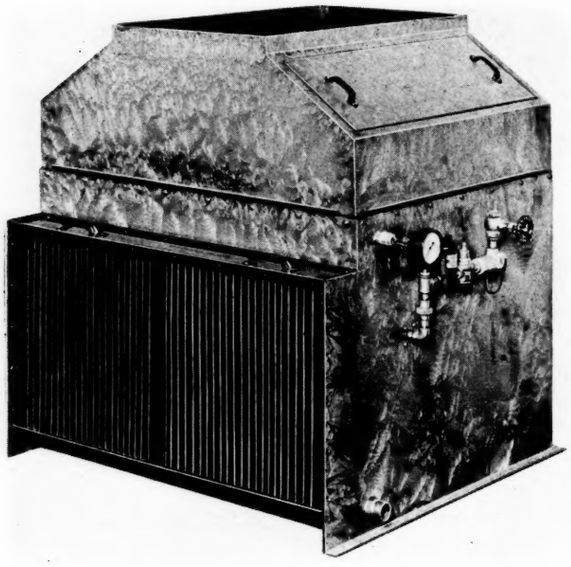
Type: One-unit-to-be-added basement *warm-air* circulating unit.

Includes: Furnace and oil burner enclosed in either round or rectangular casing. Unit contains centrifugal belt-driven fan, pan type automatic humidifier at top of furnace casing, controls.

Fuel: Oil.

Sizes and Capacities: Three sizes, one of 89,700 B.t.u. per hr. delivery capacity, another of 134,550 B.t.u. per hr., and a third of 179,400 B.t.u. per hr.

Remarks: Unit compact and low in height, inlet and delivered air ducts located at top, lacquer finish double casing. Requires connection to electric and water lines and to air circulating ducts.



L. J. Mueller Furnace Co., Milwaukee, Wis.

Trade Name: Climator.

Type: Two-unit-to-be-added types as follows: Climator II units, consisting of individual fan, air washer and filter units; Climator III (illustrated), a combination fan, air washer and filter in a single casing.

Includes: Warm-air furnace, Climator II or III units, controls, units arranged to connect to bottom of furnace casing with transition.

Fuel: Gas, coal or oil.

Sizes and Capacities: Climator II made in four sizes, with capacities ranging from 500 c.f.m. to 6300 c.f.m. at ⅛ in. static pressure. Climator III made in one size, with capacities from 1125 to 2000 c.f.m. at ⅛ in. S.P.

Remarks: Require connection to electric and water lines and to gas line if gas fuel is used; also to air circulating ducts.

National Korectaire Sales Co., Chicago, Ill.

Trade Name: Korectaire.

Type: Fabricated unit for use with *warm-air* plant.

Includes: Fan-and-filter unit containing a propeller fan, filter and humidifier.

Fuel: None (unit does not include a furnace).

Sizes and Capacities: Three sizes, capacities not available.

Remarks: Unit is intended for use with any warm-air furnace; is arranged for connecting to the furnace jacket near the bottom Filter easily removable. Requires connection to electric and water lines and to air circulating ducts. Manufacturer also offers cabinet type direct unit for humidifying and cleaning, which contains a fan, filter and humidifier. Also a portable room cooler using ice, and a stationary unit using cold water from any source.

Niagara Blower Co., Buffalo, N. Y.

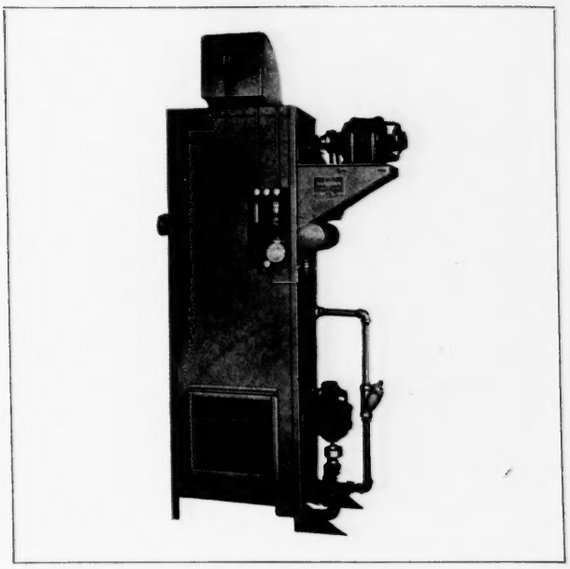
Type: Indirect unit.

Includes: Centrifugal fan, spray heads, fin tube heating surface, controls, recirculating pump, built in a sheet metal casing.

Fuel: Any—can be connected to steam or hot water system.

Sizes and Capacities: A line of sizes with air handled varying from 800 c.f.m. to 11,000 c.f.m.

Remarks: Adaptable to industrial uses and comfort work by single units or batteries. Requires connection to electric and water lines, to heating and cooling circulation piping, and to air circulating ducts if used indirect. Manufactured of aluminum for lightness, resistance to corrosion, freedom from harmful surface reaction products. Maker also offers central plant systems and units containing propeller fan for direct installations.



Parks-Cramer Co., Fitchburg, Mass.

Trade Name: ParkSpray.

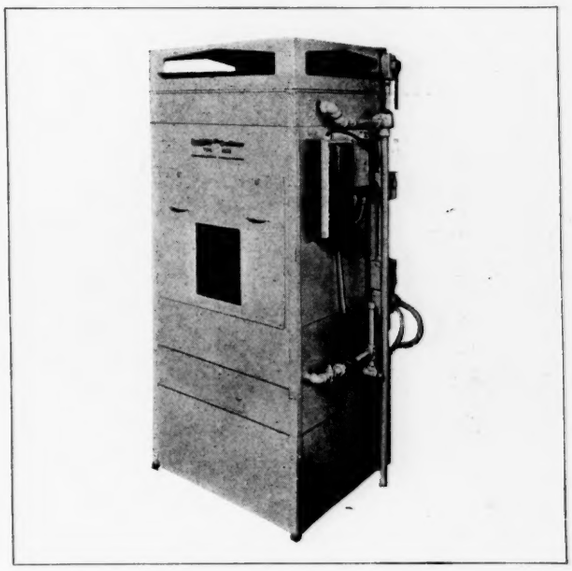
Type: Self-contained and semi-portable unit.

Includes: Centrifugal humidifying device, fan, controls, eliminators, fin type heating coil, filters—if required.

Fuel: Any—can be connected to steam or hot water system.

Sizes and Capacities: No information.

Remarks: Automatic control optional. Cooling coil may be used for either direct expansion or for cold water. Requires connection to electric and water lines, to heating and cooling circulation piping, and to air circulation if installed indirect. Maker also offers units for humidifying only in variety of styles and sizes; also equipment for central conditioning in large rooms or buildings.



Perfection Stove Co., Cleveland, Ohio.

Trade Name: Superfex.

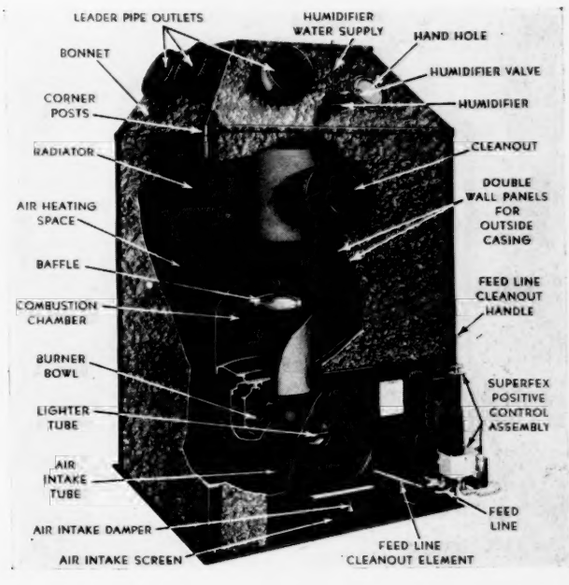
Type: One-unit-to-be-added basement *warm-air* circulating unit.

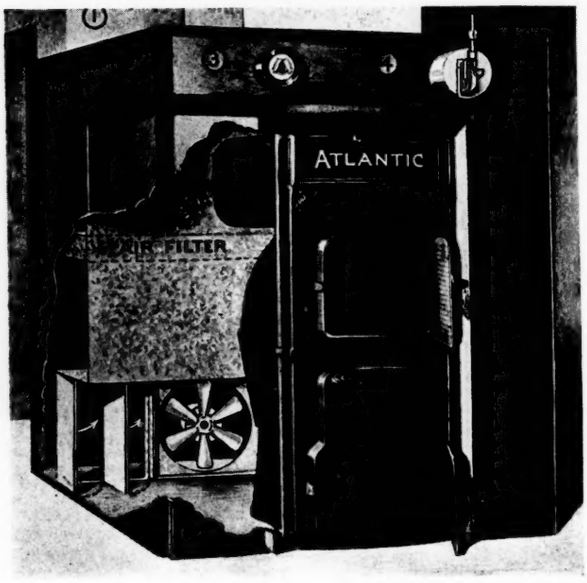
Includes: Oil-burning furnace and humidifier enclosed in rectangular casing. Unit contains air filter and fan.

Fuel: Oil.

Sizes and Capacities: Four sizes with capacities from 53,000 B.t.u. to 130,000 B.t.u. per hr., including a pipeless model with capacity of 60,000 B.t.u. per hr.

Remarks: A distinctive feature is an automatic draft control. Combustion chamber and radiator of furnace made of welded steel, firepot of ingot iron. Burns No. 1 furnace or light dŏmestic oil. Casing of furnace of double steel, in either plain galvanized or maroon enamel.





Portland Stove Foundry Co., Portland, Me.

Trade Name: New Atlantic.

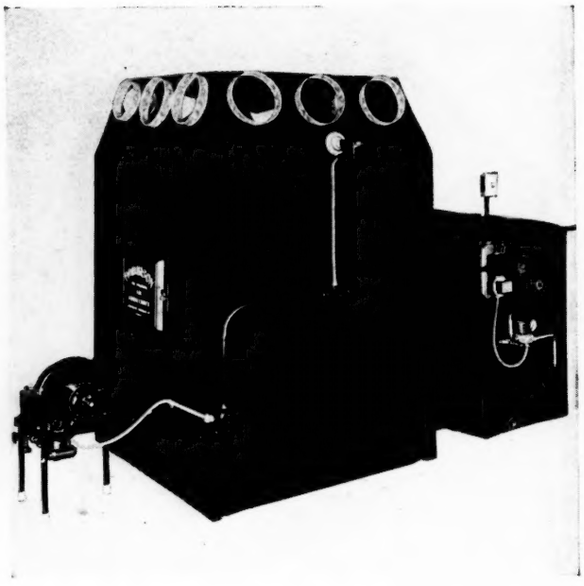
Type: Integral basement *warm-air* circulating unit.

Includes: Furnace in rectangular metal casing, automatic pan humidifier, motor-driven propeller fan with by-pass louvers or motor driven blower, filter.

Fuel: Any.

Sizes and Capacities: Various sizes, capacities from 95,000 B.t.u. to 270,000 B.t.u. per hr.

Remarks: Adapted for trunk distribution and return, both inlet and distributing ducts attached at top of unit. Requires connection to electric and water lines and to air circulating ducts.



Robinson Furnace Co., Chicago, Ill.

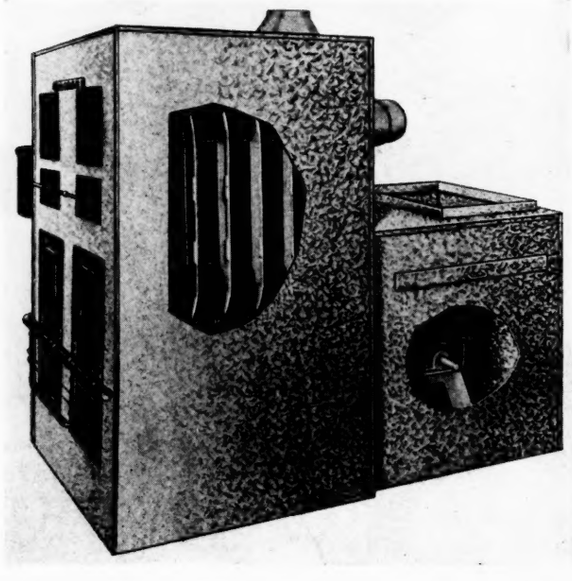
Type: Two-units-to-be-added basement *warm-air* circulating unit.

Includes: Furnace, unit containing spray type washer and eliminator plates and one containing fan and filter, controls, unit arranged for connecting near bottom of furnace casing.

Fuel: Oil.

Sizes and Capacities: No information.

Remarks: Both return and delivered air connected at top of unit; furnace arranged for individual duct distribution. Requires connection to electric and water lines and air circulating ducts.



Geo. D. Roper Corporation, Rockford, Ill.

Model: Type D.

Type: One-unit-to-be-added basement *warm-air* circulating unit.

Includes: Furnace, pan humidifier, controls, unit containing blower and filter, insulated casing.

Fuel: Gas.

Sizes and Capacities: Seven sizes, with output capacities ranging from 56,250 B.t.u. to 337,500 B.t.u. per hr.

Remarks: Equipment furnished with baked on lacquered casing and black metal trim; filters easily removable for cleaning. Requires connection to electric, gas and water lines and to air circulating ducts. Another series of eight sizes also offered with output rating from 56,250 B.t.u. to 337,500 B.t.u. per hr. with air insulated casing, and without finish.

The Rudy Furnace Co., Dowagiac, Mich.

Type: Two-units-to-be-added basement *warm-air* circulating unit.

Includes: Furnace, one unit with filter and spray, and another unit with belt-driven centrifugal fan, controls.

Fuel: Coal—convertible to oil or gas.

Sizes and Capacities: Four sizes, capacities not stated.

Remarks: Unit can be attached to furnace made by manufacturer and is also available for attaching to any furnace of suitable size. Requires connection to electric and water lines and to air circulating ducts.

The Sawyer Engineering Co.,
West Haven, Conn.

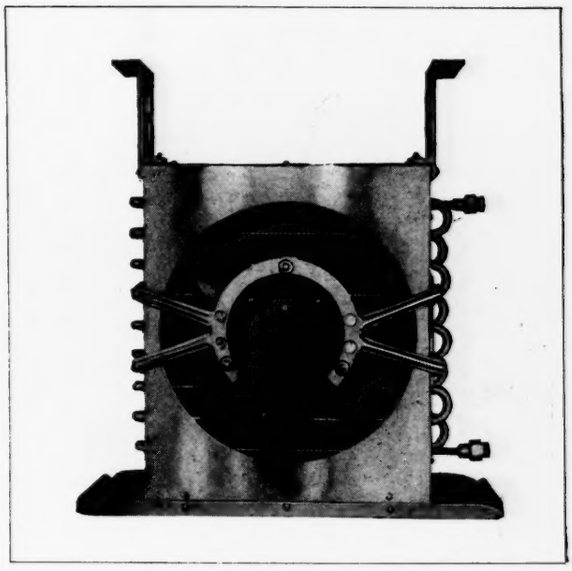
Trade Name: Humidi-Cooler.

Type: Direct unit for ceiling mounting, particularly for product cooling.

Includes: Direct-driven propeller fan, fin type cooler in metal frame with deflecting vanes.

Sizes and Capacities: Three sizes, 7200, 4300 and 1440 B.t.u. per hr. with 15° differential.

Remarks: Unit featured for use in cooling work but can be used for heating. Requires connection to electric and water lines and to heating and cooling circulation piping. Refrigerant, all common types except ammonia.



Servel Sales, Inc., Evansville, Ind.

Type: Direct cabinet unit.

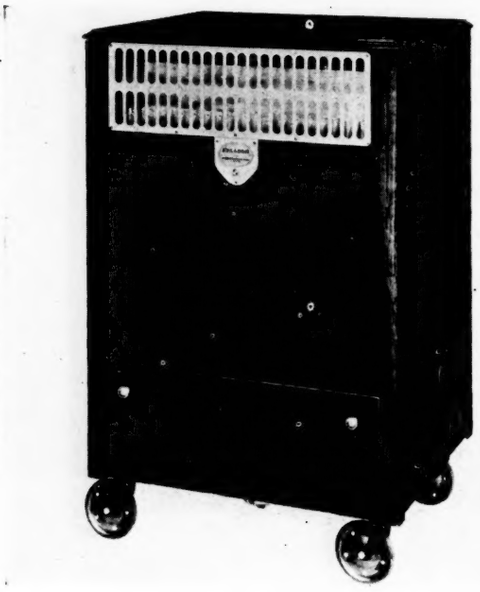
Includes: Fin type cooling coil, centrifugal fan, controls, enclosed in a finished metal insulated jacket. Heating coil and humidifying equipment available as optional.

Fuel: Any—may be used with steam or hot water heating system.

Sizes and Capacities: No information.

Remarks: Maker features this cabinet for cooling installations for summer use. Addition of heating coil and humidifier permits use in winter, in which case requires connection to heating and cooling circulation piping, and to electric and water lines. Inlet air at bottom, discharge vertical.

Maker also offers a line of refrigeration compressors for use with these units.



Standard Engineering Works, St. Louis, Mo.

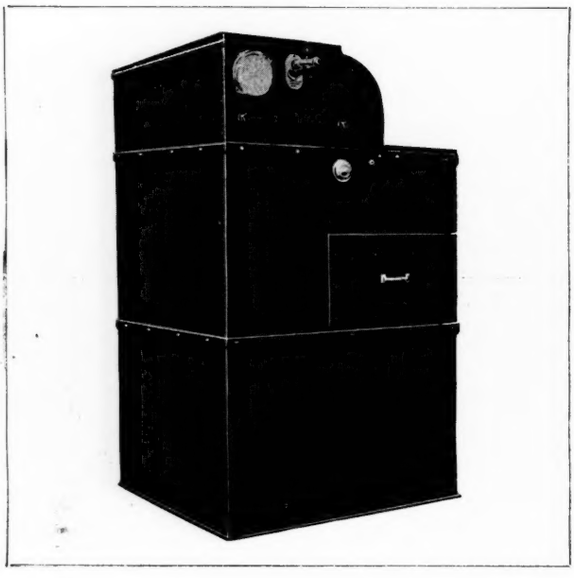
Trade Name: Kool-A-Room.

Type: Portable iced room cooler.

Includes: Finned ice tank, two centrifugal fans, insulated wood cabinet, filter, cabinet on casters.

Sizes and Capacities: 200 lb. ice capacity and 350 c.f.m. at high speed, 200 c.f.m. at low speed.

Remarks: Cooling is by the dry system and use of finned ice tank is a distinctive feature. Requires connection to electric line. Maker also offers a larger size unit, 300 lb. capacity.



Stay-Rite Co., Inc., Cleveland, Ohio.

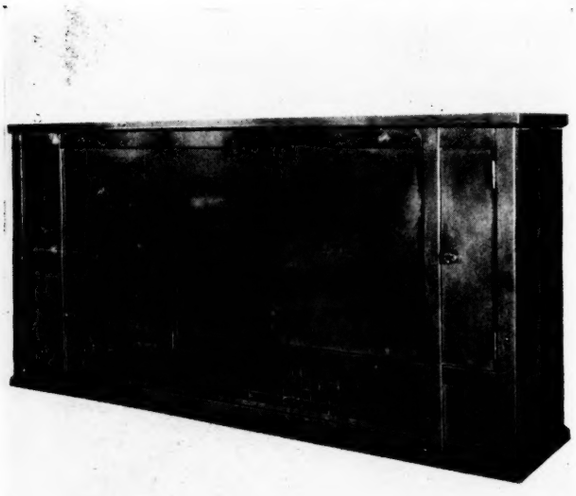
Type: Basement unit.

Includes: Centrifugal fan, filter, controls, fin type copper heating surface, drip type humidifier, enclosed in a sheet metal casing.

Fuel: Any—can be used with steam or hot water system.

Sizes and Capacities: No information on sizes, but capacity of 500 sq. ft.

Remarks: Filters readily removable, cooled water can be circulated through heating radiator. Requires connection to electric and water lines, to heating and cooling circulation piping, and to air circulating ducts.



B. F. Sturtevant Co., Boston, Mass.

Type: Direct cabinet type for room installation.

Includes: Fan, controls, humidifying radiator for winter use, cooling and dehumidifying coil for summer use, all enclosed in finished metal cabinet.

Fuel: Any—can be connected to steam or hot water systems.

Sizes and Capacities: 300 c.f.m. to 1500 c.f.m.; water evaporation up to 1½ gal. per hr.

Remarks: Maker also offers a direct unit residential humidifier, a unit heater-cooler, and a compact filter and cooler unit. Room humidifier is a humidifying radiator with a capacity of 70 sq. ft. heating surface. Heater-cooler specially adapted for stores, restaurants, etc. Filter and cooler unit for compact installations in central systems.

Surface Combustion Corp. Toledo, Ohio.

Series: K.

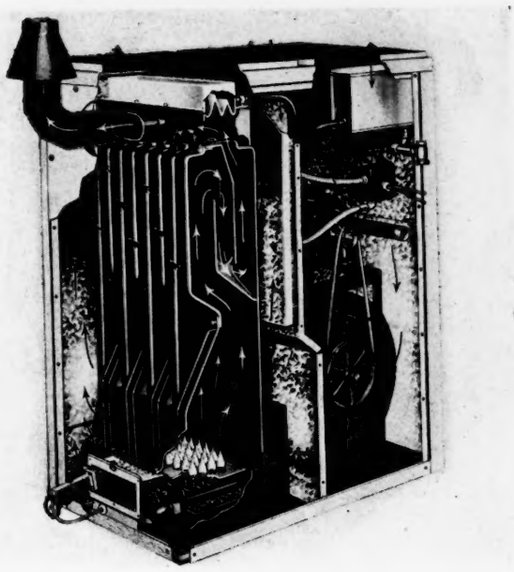
Type: Integral basement *warm-air* circulating unit.

Includes: Furnace, belt-driven centrifugal fan, controls, pan humidifier, filter.

Fuel: Gas.

Sizes and Capacities: Unit construction with hourly B.t.u. at register per unit of 57,375. Dual and triple assemblies permit capacities up to 172,125 B.t.u. per hr.

Remarks: Shipped assembled with compact casing completely enclosing controls, divided into two parts. Return and delivered air both connected at top, finished casing. Requires connection to electric, water and gas lines and to air circulating ducts. Available in multiple units side by side, in which case special construction of fan and drive is used.



The Trane Co., La Crosse, Wis.

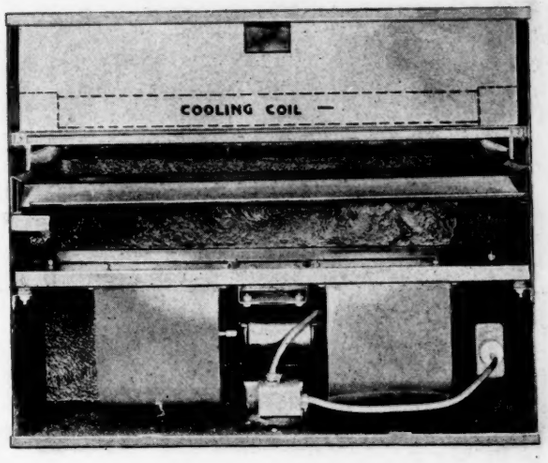
Type: Direct cabinet type.

Includes: Two centrifugal fan units, cooling coil, condensate drain pan, controls, insulated metal cabinet.

Fuel: Cabinet intended for cooling with well water, refrigerated water or direct expansion refrigerants.

Sizes and Capacities: Various sizes, capacities 265 c.f.m. to 2400 c.f.m.

Remarks: Maker also offers blower type coolers and combination heating and cooling units. Units also available for recessed installation. Room humidifier enclosed in cabinet also available. Also residential unit for winter heating and humidifying and summer cooling and dehumidifying. Uses gas or oil as fuel. Unit for steam or hot water installations also available.



The Waterman-Waterbury Co.,
Minneapolis, Minn.

Trade Name: Waterbury.

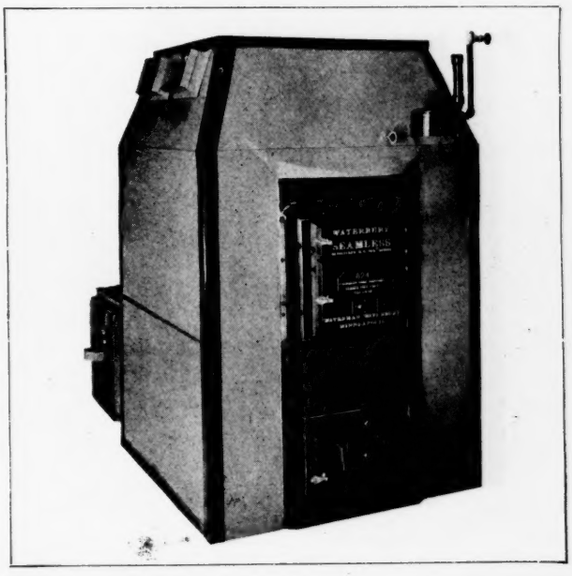
Type: Two-units-to-be-added basement *warm-air* circulating unit.

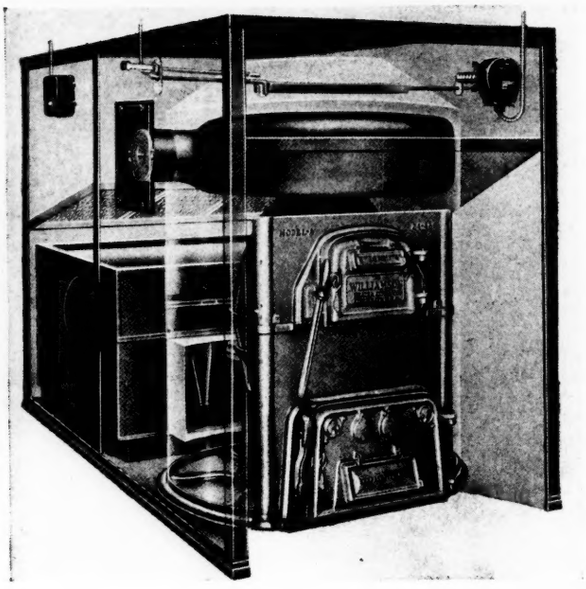
Includes: Furnace, to which may be added fabricated units as desired. Manufacturer furnishes fabricated units and advice for selection.

Fuel: Coal—convertible to oil or gas. Also oil-designed.

Sizes and Capacities: Range up to 36 in. furnace, 1327 sq. in. by standard code.

Remarks: Manufacturer makes air conditioning installations using his regular line of furnaces and has arrangements to supply fabricated units (fan, filter or washers) of several makes, as required.





The Williamson Heater Co., Cincinnati, Ohio.

Type: Integral basement *warm-air* circulating unit.

Includes: Furnace in rectangular casing, pan humidifier, centrifugal fan, filter, controls.

Fuel: Coal—convertible to oil or gas. Oil-burning designs also available.

Sizes and Capacities: Seven sizes, ranging from 79,000 B.t.u. to 150,000 B.t.u. per hr. output.

Remarks: A distinctive method of distribution and return piping combined with use of small registers. Requires connection to electric and water lines and to air circulating ducts. Maker also offers a plan consisting of a fan-and-filter unit to be added to his furnace designs.

York Ice Machinery Corp., York, Pa.

Type: Direct suspended unit.

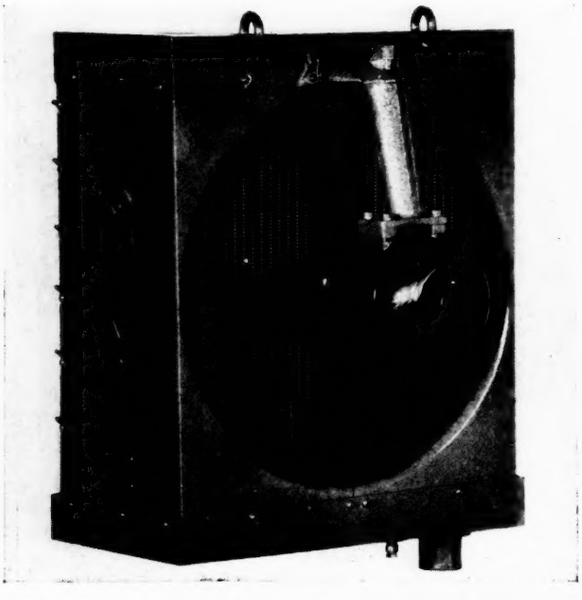
Includes: Coil surface for summer air conditioning only, which may be used for direct expansion refrigerants or for water or brine circulation (can be supplied with heating, humidifying and fresh air tempering coils for winter application), centrifugal fan, controls, all enclosed in sheet metal casing.

Fuel: Any—can be connected to any steam or hot water heating system.

Sizes and Capacities: Range of sizes and styles, capacities from 3 to 18 tons of refrigeration.

Remarks: Unit may also be used indirect. Requires connection to electric, water, and drain lines, heating and cooling circulation piping, and to ducts if used indirect.

Maker also offers suspended direct refrigerating units and a full line of other cooling equipment.



Young Radiator Co., Racine, Wis.

Type: Direct suspended unit.

Includes: Copper heat exchange surface in front of a direct-driven propeller fan, vertical eliminator plates, horizontal louvers, finished casing.

Fuel: Any—unit can be connected to steam or hot water heating piping.

Sizes and Capacities: 12 sizes for cooling, 16 sizes for heating.

Remarks: Vertical eliminators of cooling unit take moisture from air blown through, and drain pan with drain pipe connection disposes of it. Cooling units available in finishes of chromium-plated on copper or nickel, copper lacquered natural or galvanized with olive drab. Cooling unit can be used for heating by removing outside housing and connecting to steam or hot water lines.

American Furnace Co., St. Louis, Mo.

Trade Name: Afco De Luxe.

Type: Integral basement *warm-air* circulating unit.

Includes: Furnace in rectangular casing, filter, centrifugal fan, controls, pan humidifier.

Fuel: Coal—convertible to oil or gas; also a gas-burning furnace.

Sizes and Capacities: Four sizes, with capacities ranging from 130,000 B.t.u. to 300,000 B.t.u. per hr.

Remarks: Filters easily removable for cleaning. Return and delivered air connections at top. Requires connection to electric and water lines and to air circulating ducts. Maker also offers a gas-fired design of the one-unit-to-be-added type.

A. Gehri & Co., Inc., Tacoma, Wash.

Trade Name: SilentAir.

Type: Fabricated unit for use with *warm-air* plants.

Includes: Fan unit, a filter unit and a washer unit for placing side by side and connecting to a warm-air furnace, controls are included.

Fuel: None (furnace not included with apparatus).

Sizes and Capacities: Fan units from 800 c f.m. to 5800 c.f.m., a variety of sizes of washer units and filter units.

Remarks: These units may be used together or singly and may be put together in combinations. A series of smaller models also available. Require connection to electric and water lines and to air circulation.

Koolair-Maker Corp., St. Louis, Mo.

Type: Portable iced room cooler.

Includes: Fan, motor and circulating pump assembly, dry extended surface cooling coil, ice chamber, sprays can also be provided, finished casing on casters.

Sizes and Capacities: Two sizes, one 300 lb. ice and 500 c.f.m.; other 150 lb. ice and 150 c.f.m.

Remarks: May be drained by pump. Either wet or dry cooling, or both, available and may be used at the same time. Requires connection to electric line.

Doherty-Brehm Co., Chicago, Ill.

Type: Indirect unit for basement installation.

Includes: Spray nozzles, removable filter, humidifying radiator, controls, enclosed in a sheet metal casing.

Fuel: Any—units may be connected to any steam or hot water system.

Sizes and Capacities: Humidifying capacity is sufficient for buildings of residential type exceeding 30,000 cu. ft., radiator surface has capacity of 75 sq. ft., blower handles 500 c.f.m.

Remarks: Belt-driven blower is located outside unit and connected to air circulating ducts. Acoustical treatment provided to prevent noise from reaching occupied rooms. Requires connection to electric and water lines, to air circulating ducts, and to heating piping. Maker also offers humidifying radiator of the cabinet type for direct use.

The Henry Furnace & Foundry Co., Cleveland, Ohio.

Trade Name: Moncrief, Series A.

Type: One-unit-to-be-added basement *warm-air* circulating unit.

Includes: Furnace, drip pan humidifier, controls, filter, direct-connected centrifugal blower, insulated metal casing, fan and filter enclosed in separate casing for attaching to bottom of furnace.

Fuel: Gas.

Sizes and Capacities: Six sizes, with hourly B.t.u. outputs ranging from 50,000 to 200,000.

Remarks: Fan units have eight speeds, limit controls included, filter easily removable for cleaning. Requires connection to electric, water and gas lines and to air circulating ducts. Fan and filter unit available for use with existing warm-air furnace plants.

Premier Warm Air Heater Co., Dowagiac, Mich.

Trade Name: Premier.

Type: Fabricated unit for use with *warm-air* plants.

Includes: Twin air filters, water sprays located ahead of blowers, centrifugal belt-driven blower, eliminators, all enclosed in copper alloy casing arranged for attaching to bottom of furnace casing, or to ducts leading to grilles beneath radiators.

Fuel: None (unit does not include furnace).

Sizes and Capacities: No information, intended for attaching to various sizes of furnaces.

Remarks: This unit for use with any warm-air, steam or hot water system. Compactly built, filters easily removable, twin blowers, casing insulated. Requires connection to water and electric lines.

Pure-Aire Corp., Chicago, Ill.

Type: Portable cabinet type humidifier and air washer.

Includes: Centrifugal fan, water tank, eliminator, enclosed in either wood or metal cabinet mounted on casters.

Sizes and Capacities: Seven sizes, capacities varying from 6500 cu. ft. to 30,000 cu. ft. per hr.

Remarks: Air is blown into surface of water and passes up through eliminator plates to discharge. In winter used as humidifier and circulator and in summer acts as washer. Requires connection to electric line.

Thermal Units Mfg. Co., Chicago, Ill.

Type: Direct unit for ceiling mounting.

Includes: Direct-driven propeller fan behind a specially cast aluminum cooling element enclosed in a sheet steel cabinet, drip pan, moisture eliminators and deflectors, controls and automatic defrosting optional.

Fuel: Any.

Sizes and Capacities: Five models, with c.f.m. capacities ranging from 475 to 5700; cooling, one-half to nine tons per unit.

Remarks: Unit developed for cooling, can be adapted for heating by by-passing cooling connections. Requires connection to electric and water lines and to cooling and heating circulation piping.

United States Blower & Heater Corp., Minneapolis, Minn.

Trade Name: Balmi Aire.

Type: One-unit-to-be-added basement *warm-air* circulating unit.

Includes: Furnace with rectangular casing and unit to be added which contains belt-driven centrifugal fan, spray washer and baffle plates enclosed in insulated casing.

Fuel: Coal—convertible to oil or gas.

Sizes and Capacities: Six sizes of heating unit ranging from rated capacity of 493 sq. in. to 1327 sq. in. of warm-air pipe.

Remarks: Unit requires connection to electric and water lines and air circulating ducts. Fan unit for attachment to furnace is also available, as well as equipment for heating and humidifying.

Wood Hydraulic Hoist and Body Co., Detroit, Mich.

Trade Name: Gar-Wood.

Type: Integral basement *warm-air* circulating unit.

Includes: Furnace, centrifugal fan, spray type washer and eliminator, plates, pan humidifier.

Fuel: Oil.

Sizes and Capacities: No information.

Remarks: Unit is especially designed for oil-burning and features an economizer and distinctively shaped combustion chamber. Oil burner built integrally with furnace. Requires connection to electric and water lines and to air circulating ducts.

Supplementary List

UNITS made by following manufacturers are, in general, not referred to by the maker as air conditioning units, but since they can be used in small buildings and rooms, and are similar in this respect to some of those already listed, they are added in order that the list may be more complete.

American Air Purifier Corp., New York, N. Y.—Humidifiers. One for basement installation, and one portable.

Aqualator Division, Wilcolator Corp., Newark, N. J.—Humidifiers. Wall and cabinet models, using jet principle.

Bahnson Co., Winston-Salem, N. C.—Humidifiers. Portable type.

Hexcel Radiator Co., Milwaukee, Wis.—Humidifiers. Portable type. Maker uses words "air conditioning" in literature.

Manufacturers Machine Co., North Andover, Mass.—Humidifiers. Portable type.

Swartzbaugh Manufacturing Co., Toledo, Ohio.—Humidifiers. Portable pedestal type containing fan.

Utility Heater Co., New York, N. Y.—Humidifiers. Suspended cabinet type.

Walton Manufacturing Co., Inc., Newark, N. J.—Humidifiers. "Airite" available in several styles as urn, vase or fernery. Element may be purchased separately. Also "Fragrant-Aire" for diffusing pleasant odors.

A Summary

ALPHABETICAL listing and the fact that some makers offer more than one product make it inconvenient to summarize directly from the preceding pages. The total number of makes of each type of equipment of which we have definite record follows:

Warm-Air Group

Integral type plants	11
Units-to-be-added plants	22
Separate fabricated units	12

Steam and Hot Water Group

Permanent direct cabinet units	20
Permanent wall-built or flush-mounted	17
Portable direct units (ice cooled)	13
Portable direct units (humidifying, etc.)	9
Unit conditioners (direct or indirect)	8
Indirect units (basement or central)	12

Collecting all the equipment data makes it possible to examine each of the types more closely and to note tendencies and trends in each group.

* * *

Of the 11 integral warm-air units, two are equipped with sprays for humidification, while the other nine use pans or jets of water, or similar means. All use centrifugal fans, with a propeller type fan offered as optional equipment in one case. Only two of these plants make provision for burning coal; seven are gas-fired; one is oil-fired, while one can be used with either oil or gas. None makes any provision for summer cooling except by air circulation, but the two which contain spray type humidifiers can be connected to cool if desired. Cooling with dehumidification in summer is not stressed with any of these units, and operation of the fan in summer is referred to as the cooling provision made.

The units-to-be-added plants, which include a furnace furnished with the units, contain a humidifier without exception. Of the 12 makes, 10 are equipped with both a fan and filters; seven contain a fan, filters and washing device; while four of the makers apparently plan on adding a fan unit alone. As would be expected, the fuel most widely used is coal, for these plants make use of existing furnace designs. In 12 of the 22 plants, coal can be used; six are designed especially for use with gas, and the remaining four are essentially oil-burning furnaces. As with the integral units, none of these plants features summer cooling beyond operating the fan, although the seven which contain spray washing devices can be used to cool by supplying cold water to the sprays. Cooling with dehumidification in summer is not stressed, and summer operation of the fan is featured in connection with cooling.

To anyone who looks over the equipment available for warm-air installations, two points are likely to stand out. One is that so many of the equipments offered are definitely intended for use with gas as a fuel, and the other is the slight attention given to the summer functions.

The predominance of gas designs is surprising in some ways. On the other hand, many of these equipments are definitely intended for high-class residential buildings and the advantages of using gas as a fuel apply especially to such buildings. Use of gas also permits close control of the operation and reduces attendance. The relative scarcity of designs specifically intended for use with oil is equally surprising, in view of the usual aggressiveness of the oil-burning interests.

Regarding the point of view which causes the use of air circulation as the only cooling means, there can be endless argument. The simple fact remains, however, that at present the great majority of the warm-air equipments are not provided with any other cooling means. It is true that they can be readily added, but, the stress placed on the adequacy of air circulation alone must be interpreted to mean that either this provision is found adequate, or else the use of other cooling means is still too expensive to carry appeal in the buildings in which these plants are used.

Of the 20 direct cabinet units of which we have record, seven are essentially winter devices and can be used only incidentally, if at all, for summer cooling in addition to permitting their fans to operate. They can thus be considered as adjuncts, or parts of the heating installation and go to either add functions not obtained in winter without their use, or else they add refinements to the winter functions. Two of the cabinets are distinctly for summer use and make no provision for winter use except that their fans may be operated if desired. The remaining 11 are for year-round use, incorporating definite provision for operation during all seasons of the year and implying the use of cooling with dehumidification in summer.

Direct units of the suspended or wall-mounted type resembling unit heaters are available in nine makes. Some of them are fitted up for use only as coolers with direct expansion of a refrigerant. Where the unit is thus operated it is not practical to send steam or hot water through it for winter use because of the likelihood of mixing the steam or water with the refrigerant even if careful draining were possible. Those for use throughout the year usually make use of water as the circulating substance with indirect cooling.

The eight unit conditioners are so equipped that they can be operated the year round, and imply the use of cooling with dehumidification in summer.

Of the 12 indirect or basement units, seven are equipped for year-round functioning in the sense that they make provision for summer cooling with dehumidification.

In examining the steam or hot water group of equipments, one outstanding point is that the majority of

these units are definitely provided with arrangements which will let them cool and dehumidify, if wanted. They thus place more stress on the summer features than do those of the warm-air group. This is again probably explainable on the basis that they are intended largely for use in rooms or buildings wherein some summer cooling with dehumidification is wanted and where, presumably, the owners are able to pay the cost, usually through increased business obtained.

Equipment Trends

The present units have appeared on the market in the course of the past few years, during which time it has been freely predicted that the idea of air conditioning would sweep the country. In view of this it is interesting to see if it is true that there has been a continually increasing rate of appearance of new equipment as would be expected if this sweep is taking place. Also it is interesting in a group summary of this kind to include the dates of appearance of the various makes of apparatus now available.

In order to collect this information we have used two sources. One is the New Equipment section of HEATING AND VENTILATING which records each month the appearance of all major items of equipment. In addition, and to check our dates, we addressed questionnaires to interested manufacturers asking for the year when they entered the air conditioning field.

The photograph on the cover shows a modern small theater, the Lobero, in Santa Barbara, Calif. George Washington Smith, architect. Photograph by Dapprich. Reproduced by courtesy of "The Architectural Forum."

In the warm-air group we were thus able to account for 34 makers of plants whose products have entered the field as follows:

Prior to 1931	18
1931	13
1932	3

These figures should not be interpreted to mean that changes in models, improvements, etc., have not been announced at other times. They show the years when these firms actually entered the air conditioning field with a product. Nor do the figures indicate the number of firms which have entered products, but do indicate the ones who entered products and whom we can identify as having survived to date.

In attempting to draw up similar figures for the steam and hot water groups, the complication enters that a good many of the firms now having products of this kind on the market are the same ones who have been engaged in air conditioning work in factories and theaters for some years, and who have turned attention to the smaller building units but recently. Showing when such firms entered the general field would not tell the story so far as their products for small building work is concerned. We must use a method which will do this.

We have a record of 40 separate firms of this group who now definitely have available products which can reasonably be called factory-built units suitable for use in small buildings. Of these we can identify 18 as having entered their products during the calendar year 1932, and who did not before have products which could be put in this class. On the same basis we identify seven who entered their products during 1931. The remaining 15 must have entered at least some product prior to 1931. On that basis we can set up figures comparable to those for the warm-air group as follows:

Prior to 1931	15
1931	7
1932	18

Further analysis of dates also shows that the products announced prior to 1931 were made up to a notable extent of winter devices, while those entered during 1931 and 1932 are either summer equipments alone, or else year-round units.

In connection with collecting information on the warm-air group of units, we addressed a questionnaire to a large group of firms known to be well established manufacturers in their field. Among other questions we asked the following:

If you are not at present manufacturing air conditioning equipment, do you contemplate doing so during the present year?

Answers received were surprising, and we offer a summary. Only six answered "yes." Another group answered "no", and some of these set forth their position in full. One wrote, "We will not bring out such equipment unless present producers begin to realize that nature has a few facts that must be obeyed." Another wrote, "It is the writer's conviction none of the air washers on the market are a success, but that they develop leaks and produce excessive humidity which is very objectionable under certain conditions."

Replies to the questionnaire were exceptionally complete on this point, and the impression is very definite from the replies that the "old-line" manufacturers of warm-air furnaces are neither unanimous in believing that the innovations are going to take, nor are they by any means all expecting to rush in with a product in the immediate future.

Another point regarding the present equipment situation is the background of the firms offering units. In the warm-air group we are able to identify five who have entered the air conditioning field without having previously been makers of heating equipment. The others were engaged in manufacturing warm-air furnaces before the idea of air conditioning small buildings became popular. In the steam and hot water group 18 firm names are those of manufacturers to whom the addition of air conditioning units is more or less an extension or diversification of their line of heating equipment. The others have either entered from other manufacturing activities, or have been formed for producing the air conditioning units. Among those entering from other fields are five firms whose principal activities heretofore have had to do with refrigeration. Another seven names are those of manufacturers whose specialties are either for cooling or humidifying, and whose products and names are both comparatively new to the field.

The Small Building—
What About the Market?

THE small building market can be divided into three general groups:

1. The residential market, consisting of single and two-family detached houses, both existing and prospective.

2. The apartment market, which can be classed with the large building group in which central systems would be installed, but which, due to the division of space, can be considered as being divided into a number of small spaces similar to a small building. This consideration holds for at least some types of conditioning equipment.

3. The commercial market, which also consists largely of small divisions of space in large buildings, the small spaces being devoted to commercial enterprises in which air conditioning would be installed primarily to give increased comfort to clients or customers, with resulting higher profits, and secondarily to make the employees more comfortable and more efficient.

The Residential Market

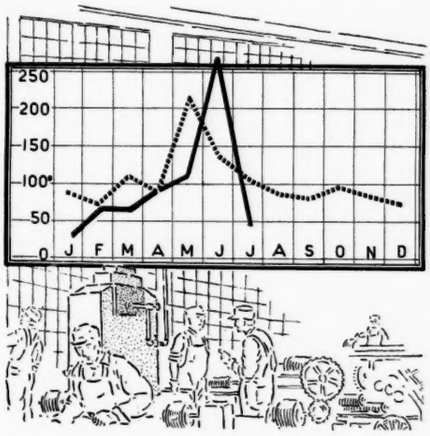
It is an easy matter to set down a numerical equivalent of the existing residential market. It consists of about 29,000,000 dwellings, covering the whole country. The difficult part is to determine just how much of this ultimate is in any way immediate. In order to make an estimate we must consider a number of factors.

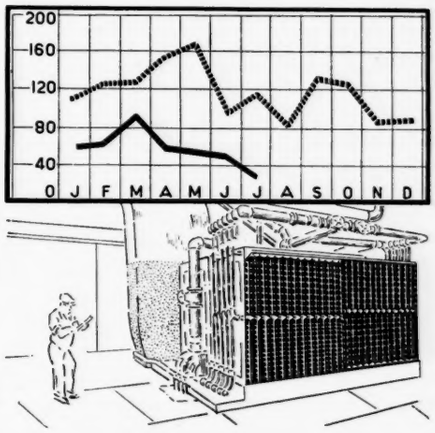
Since the majority of rural homes have not been equipped with central heating, it is reasonable to believe that they will not constitute an important market, at least during the next few years, for air conditioning devices. For this reason the rural homes will be omitted from our study of the market. Subtracting the number of these from our total, we find 16,780,000 dwellings in urban (over 2500 population) communities.

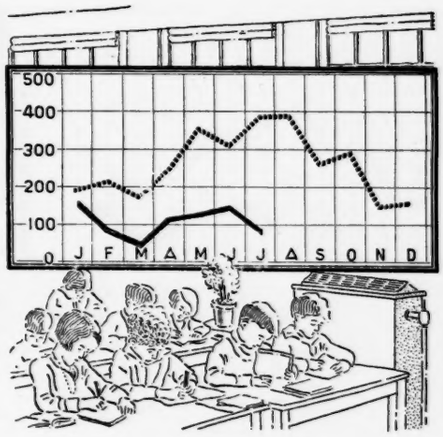
About 1,000,000 families live in 60,000 apartment houses in urban communities, so that to determine the detached dwelling market we can subtract 60,000 from the 16,780,000 and obtain for the urban detached residential market the number 16,720,000.

Is this our prospective market? By no means, for we have not separated the homes occupied by families with an income too low to be logical prospects for a luxury product. From a study of the market with this angle in mind, we find that about 62% of the urban residences are owned and about 38% rented, the numbers thus being 10,366,000 and 6,354,000, respectively. On the basis of census returns for a typical city, 25% of the owned homes are valued at $7500, or over. In view of the decline in values since the 1930 census, the present figures would probably be that 25% of the *owned* homes are worth over $6000. A recent survey by a leading eastern university in a large number of cities showed that 6% of the families *renting* homes in urban communities are living in dwellings valued at over $6000.

For estimating purposes, let us assume that homes costing over $6000 are the ones in which air condition-







AIR WASHERS AND AIR CONDITIONING UNITS
(Orders in Dollars)

	1931	1932
January	$87,570	$29,557
February	73,200	68,712
March	111,665	66,716
April	90,465	91,977
May	214.626	111,068
June	138,858	266,606
July	104,045	48,145
August	87,368	.....
September	81,408	.....
October	97,783	.....
November	85,028	.....
December	74,663	.....
	$1,246,679	

INDIRECT HEATING SURFACE
(Orders in Dollars)

	1931	1932
January	$110,535	$59,976
February	124,368	61,178
March	126,652	91.676
April	154,341	57,159
May	165,970	54,034
June	96,538	50,071
July	116,107	27,134
August	82,807	.....
September	131,790	.....
October	125,020	.....
November	88,395	.....
December	89,104	.....
	$1,411,627	

UNIT VENTILATORS
(Orders in Dollars)

	1931	1932
January	$196,359	$158,299
February	217.387	84,523
March	175,046	45,565
April	248,618	108,953
May	352,807	127,329
June	312,387	140,968
July	388,206	91,759
August	388,317	.....
September	262,274	.....
October	291,223	.....
November	151,745	.....
December	156,588	.....
	$3,140,957	

ing will find its primary market. This is almost identical with saying that it is the home rented by a family having an income of $3000 a year, and is the lower limit of prospects for oil burners set by an authority in that field. On the basis that the monthly rent should not exceed one week's income, and that the value of a house is ten times the annual rental, the $3000 income and the $6000 home are almost identical criteria.

Applying our 25% to the 10,366,000 owned homes, and the 6% to the 6,354,000 rented homes, we find that there are 2,973,000 urban homes valued at over $6000.

Is this our prospective market? Yes, but we are hardly so optimistic as to believe we will sell all of them. Even the radio has been sold to only 40% of the country's families. It is interesting to note that in the oil burner industry, some of the best sales staffs find that even now, when the oil burner is rather well accepted, they must have 12.5 prospects to make 1 sale. In view of these facts, let us assume that 20% of the 2,793,000 prospects may be considered reasonably immediate. On this basis our prospect list of existing residences consists of 594,000.

The new building, that is, the new detached residential building, is of a somewhat different character. The average number of residences built during the last four years was about 124,000 a year. Of these, it is estimated that 90,000 were urban dwellings, and applying the same value factors to these as to existing buildings, we would find that about 21,000 new homes per year will be good prospects.

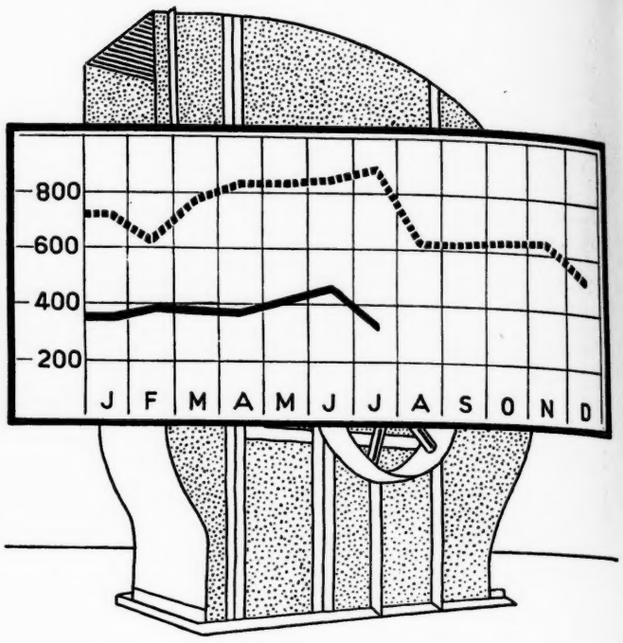
These buildings should be very good prospects for the reason that they are not already equipped with devices for accomplishing the winter functions, as are the existing buildings, and it will cost relatively a small amount more to install equipment to satisfy the summer and winter demands than it will to install a heating system only.

The residential market, according to our estimate, thus consists of 594,000 existing homes and 21,000 new homes built each year. Having determined the size of our market, the next question facing us is: *When will this market be sold?*

One organization has estimated that 600,000 units will be sold to this market in the next *five* years. On the basis of accomplishments of the electric refrigeration industry this figure seems reasonable enough, but air conditioning is distinctly not a package proposition. It must be considered in relation to the heating system and requires at least simple engineering. Air conditioning in this respect compares with the oil burner, a product which has sold to the number of 600,000 (in *existing* and *new* buildings) in the last *ten* years, by an industry which compares favorably with any other with regard to progressive selling. It should be borne in mind that this ten-year period has covered a decade when incomes reached peaks never before approached.

The year 1922 was the first really important one for the oil burner. For the five-year period beginning with 1922 and ending with 1926, 166,000 mechanical draft burners were sold. In the following five years. 455,000 of the same type units were sold.

Thus, it is difficult to see that a number greatly in excess of 600,000 conditioning units could be sold in less that a decade to both new and existing buildings and, further, we can hardly expect that more than 200,000 can be sold in the coming five years. Public acceptance cannot be secured overnight.



UNIT HEATERS
(Orders in Dollars)

	1931	1932
January	$240,576	$144,260
February	195,243	100,351
March	175,410	101,501
April	171,165	64,111
May	173,724	88,722
June	222,566	86,658
July	298,986	78,911
August	268,821	.....
September	420,410	.....
October	431,605	.....
November	420,299	.....
December	273.520	.....
	$3,292,325	

Consider also what has been happening in the heating industry during the past ten years. We have seen oil, gas and stoker-fired installations sold to the public as the last word in automatic heating. Especially have the oil-fired heating systems obtained considerable public acceptance. These devices largely eliminate the drudgery connected with operating the heating plant, and this probably is their strongest selling point. These several groups will continue to exert strong selling effort, and it is easy to see that the selling of automatic heating may easily work directly against the selling of air conditioning. With the homeowner being under pressure to purchase an oil burner, or an air conditioning system, with both valued at approximately the same amount, it is quite possible that he will turn to automatic heating rather than to air conditioning, in spite of some of the advantages of the latter, because these advantages are not so obvious as that of elimination of drudgery. It might be possible to sell the owner of an existing residence both the oil burner and the conditioning system, but in this case it would double the investment he would be asked to make, and would increase his annual operating costs.

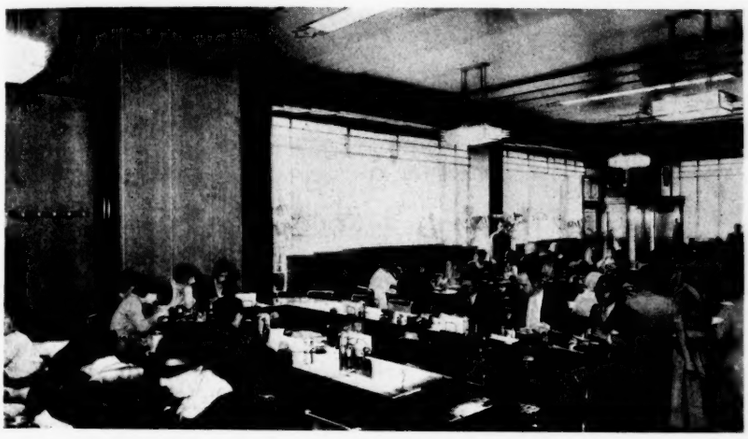
In view of these considerations, we are inclined to believe that the new building may prove to be relatively the best market after all, and that the figure of 200,000 total installations with any measure of year-round functioning is plenty optimistic for the next five-year period.

A Niagara Blower indirect conditioner system keeps this Broadway, New York, restaurant comfortable and inviting throughout the year.

An installation of a Frigidaire mechanical room cooler which cools and dehumidifies the air in this midwestern restaurant.

Restaurant Conditioning—

A Sales Stimulus



A 24-hr., 100-seat Wil-Low Cafeteria in New York, in which 11g unit coolers and a Frick ammonia compressor are used.

The neat and unobtrusive conditioning cabinet below is made by the American Blower Company.

View of entrance to the Oreole Cafeteria, Baltimore, using a York Ice Machinery system. Reader, Eiser and Akers, the engineers, had a difficult problem, complicated by the mezzanine which allows headroom of only 8 ft.

The Apartment House Market

Of the 60,000 apartment houses, it is doubtful whether more than 5000 of them are prospects of the group which will fall in the class of small buildings in which the owner will be interested in installing a central system. Many of the larger apartment houses may go in for such systems, but they are not, of course, part of the market we are discussing. Tenants of apartment houses will be a difficult class to whom to sell air conditioning, for the reason that the majority of units require some sort of permanent connections in the way of drains, water piping, etc. The tenants on long-term leases paying quite high rentals will constitute a market, but it is estimated that only 60,000 of the 1,000,000 families in apartments have an income greater than $3000, and assuming that 10% of these are prospects, we have a total of 6000 families renting apartments who may make up the most important part of this market.

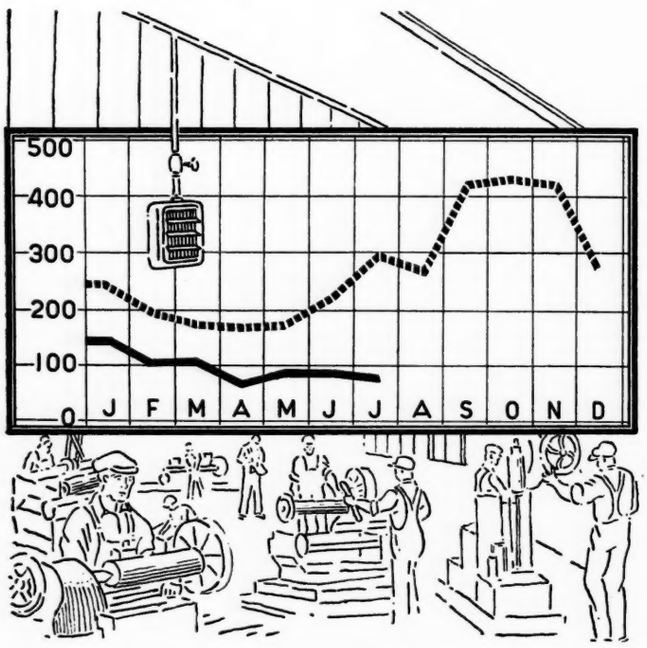
The Commercial Market

This group can be estimated numerically, but in quite a different manner from the preceding groups. The accompanying table shows the potential, estimated arbitrarily, in the more important commercial groups.

The method used in estimating this market was to apply a judgment factor against the total number of the particular type of business being considered. Obviously, different factors are used for different businesses. For example, beauty shops are good prospects for conditioning due to the large heat load, and to the type of patronage. Jewelry shops, on the other hand, are relatively poor prospects.

The commercial market is one where real business can be expected. Sales arguments are powerful where coupled with the expectancy of increasing business and consequent increased profits.

Type	Total	Estimated Potential
Banks	20,000	1,000
Barber shops	50,000	1,500
Beauty shops	60,000	9,000
Clubs	8,000	2,000
Confectionery stores	60,000	1,500
Dentists	60,000	4,200
Drug stores	60,000	1,000
Florists	12,000	1,200
Funeral directors	28,000	8,000
Hotels	26,000	4,000
Hotel concessions	13,000	6,500
Hospitals	9,400	7,500
Jewelers	16,000	500
Medical offices	150,000	7,500
Millinery stores	40,000	2,000
Radio broadcasting	700	600
Restaurants	80,000	8,000
Soda fountains	105,000	6,000
Shoe stores	32,000	1,500
Theaters	22,500	6,500
		80,000



Fans and Blowers—All Purposes
(Orders in Dollars)

	1931	1932
January	$719,660	$360,611
February	629,458	388,488
March	778,565	382,890
April	830,231	386,359
May	830,724	413,684
June	852,059	452,377
July	888,575	332,305
August	621,211	.....
September	620,415	.....
October	630,490	.....
November	641,526	.....
December	513,930	.....
	$8,556,844	

Sales

The charts presented on these pages show the data which have been reported for the years 1931 and 1932 by the Department of Commerce. The figures were not reported prior to 1931.

Data are quite properly published as Air Conditioning Equipment, for the equipments included are used for air conditioning. However, many are also used in straight heating and ventilating applications. In fact, undoubtedly the majority of fans and blowers sold are for such purposes as ventilation of buildings, mechanical draft, and other purposes which are not air conditioning applications. The classification Indirect Heating Surface, includes the cast iron and extended surface types which are commonly used in indirect heating systems. Unit Heaters fall only under air conditioning in the broader sense, while the same is generally true of Unit Ventilators. Air Washers and Air Conditioning Units, another classification, are strictly air conditioning equipments.

The foregoing is not intended as a criticism of the Department of Commerce, which is doing a splendid work in assembling and reporting these data each month. Market investigators are merely warned to regard these points when interpreting them.

The following table shows the dollar volumes as reported by the Department of Commerce for some of the classes included in the Air Conditioning Equipment group.

	First Six Months, 1932	First Six Months, 1931
Fans for public and semi-public buildings	$536,861	$1,104,382
Direct connected housed, and propeller fans and motors	466,111	815,901
Unit heaters	585,603	1,178,684
Unit ventilators	665,637	1,502,604
Indirect heating surface	374,094	778,404
Air washers	190,419	407,125
Air conditioning units	270,826	309,259

New Rules for Forced Warm-Air Jobs

Through the courtesy of the National Warm Air Heating Association we are able to present the Tentative Code for the Installation of Mechanical Warm-Air Furnace Heating Systems for Residences. The Code, presented on these pages, has just been completed by a committee of the association, headed by Prof. J. D. Hoffman, working with a committee from the Furnace Blowers Manufacturers Association.

Intent of the Code: These tentative rules are submitted with the idea of expressing their provisions in such form that they may be understood and applied by anyone. They are intended to serve until such time as a final and more precise code for mechanical warm-air furnace heating is evolved.

Article 1—Definitions

Section 1. Forced or mechanical warm-air heating systems to which these rules refer shall consist of one or more warm-air furnaces within individual casings or within one common casing, one or more motor-driven blowers, smoke or vent pipes, individual leader pipes or trunk line systems with necessary control dampers for supply and return air, registers, faces and grilles, and with provision for other appurtenances, such as filters, air washers, ozonators, humidifiers, etc., as may be desired; furthermore, manual or automatic controls for any or all apparatus installed.

TABLE 1

Register Air Temp.	Factor
150	10.9
145	11.6
140	12.3
135	13.2
130	14.2
125	15.4
120	16.8

Section 2. An individual duct system for either warm or cold air shall consist of separate pipes of round or rectangular cross section, each style to be of the same equivalent size throughout its full length and without branches, extending to or from the heating unit.

Section 3. A trunk line system for either warm or return air shall consist of one or more main ducts extending outward from the heating unit, with one or more branch ducts from each main duct to the rooms or parts of the building being served.

Article 2—Calculations

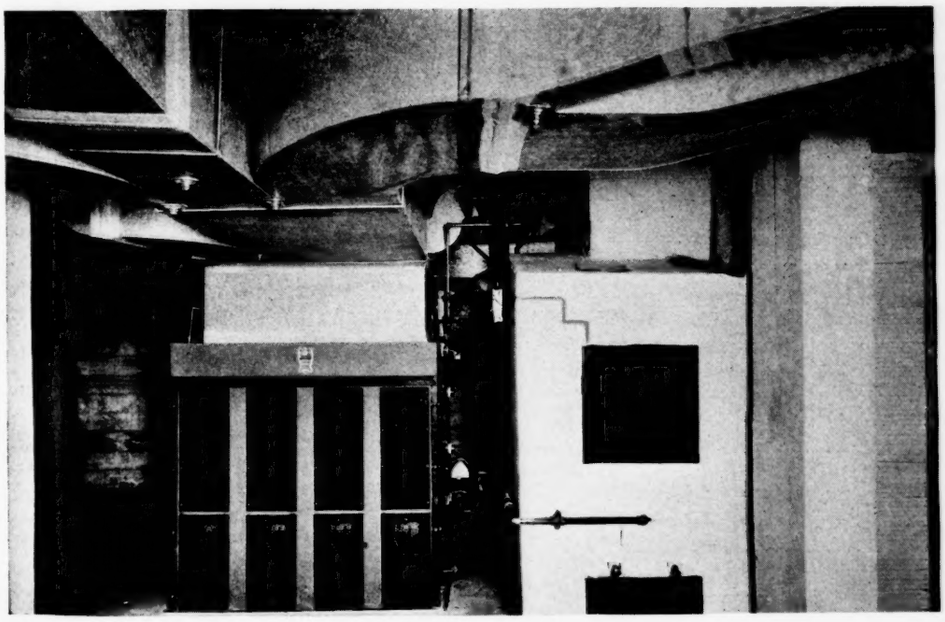
Section 1. Determination of the basic factor for each room and for the house.

(a) Divide square feet of exposed glass surface by 12. (See Note 1).

(b) Divide square feet of net exposed wall surface, cold ceiling or cold floor, by factor in Table A. (See Note 2).

(c) Divide cubic contents of room by 800. (See Note 3).

(d) Add the results of (a), (b), and (c). The above rules are for 70° temperature difference (outside temperature zero, inside temperature 70°). When temperature difference is more than 70°, add 1.5% per degree to the above sum. When temperature difference is less than 70°, deduct 1.5% per degree from the above sum. For rooms having unusual exposure (ordinarily north, northeast and north-



It is for rectangular duct systems—such as shown in this gas-fired conditioner installation—that the accompanying code is intended.

west), add 15% to the sum of the above quotients.

(e) The result obtained from (d) for each room is the room basic factor, to be applied later.

(f) The sum of the room basic factors is the house basic factor.

This factor is used in estimating the furnace size. (See Article 3, Section 1, (a).

Table A

Exposed Wall

		Factors
No. 1	(a) Frame Wall constructed of siding, paper, sheathing, studding, lath and plaster	60
	(b) Same (1-a) construction substituting ½" fibrous board or equivalent for the lath	80
	(c) Same (1-a) construction with additional 3½" insulating fill between studding	140
	For stucco on frame walls, use the same values as for frame with siding, as shown in (1-a), (1-b) and (1-c).	
No. 2	9" Brick wall plastered on one side	40
No. 3	(a) 9" Brick wall, air space, furred and plastered	57
	(b) Same (3-a) construction substituting ½" fibrous board or equivalent for the lath	84
No. 4	13" Brick wall, plastered on one side	52
No. 5	(a) 13" Brick wall, air space, furred and plastered	69
	(b) Same (5-a) construction substituting ½" fibrous board or equivalent for the lath	97
No. 6	4" brick, 4" or 8" hollow tile plastered	57
No. 7	(a) 4" brick, paper, sheathing, studding, lath and plaster, (brick veneer)	58
	(b) Same (7-a) construction substituting ½" fibrous board or equivalent for the lath	84
	(c) Same (7-a) construction with additional 3½" insulating fill between studding	158
No. 8	Stucco on 8" Hollow tile, and plaster	48
No. 9	(a) Stucco on 8" Hollow tile, furred and plastered	65
	(b) Same (9-a) construction substituting ½" fibrous board or equivalent for the lath	95

CEILINGS—WITH ATTIC SPACE ABOVE

No. 10	(a) Lath and plaster without floor above	50
	(b) Same (10-a) construction substituting ½" fibrous board or equivalent for the lath	70
	(c) Same (10-a) construction with additional ½" fibrous board or equivalent nailed on top of joists	90
	(d) Same (10-a) construction with additional 3½" insulating fill between joists	150
No. 11	(a) Lath and plaster with tight floor above	90
	(b) Same (11-a) construction substituting ½" fibrous board or equivalent for the lath	104
	(c) Same (11-a) construction with additional 3½" insulating fill between joists	183
No. 12	(a) Metal without floor above	40
	(b) Same (12-a) construction with additional ½" fibrous board or equivalent between metal and joists	65
	(c) Same (12-a) construction with additional ½" fibrous board fastened on top of joists	85
	(d) Same (12-a) construction with additional 3½" insulating fill between joists	145
No. 13	(a) Metal with tight floor above	75
	(b) Same (13-a) construction with additional ½" fibrous board between metal and joists	95
	(c) Same (13-a) construction with additional 3½" insulating fill	176

CEILINGS—WITHOUT ATTIC SPACE ABOVE—PART OF THE ROOF

No. 14	(a) Lath, plaster, rafter, sheathing, any type of shingles or roofing	57
	(b) Same (14-a) construction substituting ½" fibrous board or equivalent for the lath	74
	(c) Same (14-a) construction with additional 3½" insulating fill	130

FLOORS OVER EXPOSED OR UNHEATED SPACES

No. 15	(a) Double floor, on joists	42
	(b) Same (15-a) construction with additional ½" fibrous board fastened to bottom of joists	88
	(c) Same (15-a) construction with sheathing fastened to bottom of joists and with additional 3½" insulating fill between joists	140
	The substitution of ½" insulating materials for sheathing should not be considered as having any additional insulating value.	

Section 2. The air supply for each room in c.f.m. is obtained by multiplying the room basic factor by that factor in Table 1 representing the desired register air temperature. For example, if the desired register air temperature is to be 135°, use 13.2; if register air temperature is to be 140°, use 12.3, etc.

Section 3. Round individual warm-air ducts.

(a) The cross sectional area of a round individual warm-air duct in square inches for a given room shall be obtained by multiplying the room basic factor by the factor in Table 2 representing the desired air velocity. For example, at 500 f.p.m. and 135° register temperature, the factor is 3.8; at 400 f.p.m. and a register temperature of 125°, the factor is 5.6.

TABLE 2

Air Velocity	Register Air Temperature, °F. (Return Air) Temperature Being 65°						
F.P.M.	120	125	130	135	140	145	150
200	12.1	11.1	10.2	9.5	8.9	8.3	7.8
250	9.7	8.9	8.2	7.6	7.1	6.7	6.3
300	8.1	7.4	6.8	6.3	5.9	5.6	5.2
350	6.9	6.4	5.9	5.4	5.1	4.8	4.5
400	6.1	5.6	5.1	4.8	4.4	4.2	3.9
500	4.9	4.4	4.1	3.8	3.6	3.3	3.1
600	4.0	3.7	3.4	3.2	3.0	2.8	2.6
700	3.5	3.2	2.9	2.7	2.5	2.4	2.2
800	3.0	2.8	2.6	2.4	2.2	2.1	2.0
900	2.7	2.5	2.3	2.1	2.0	1.9	1.7
1000	2.4	2.2	2.1	1.9	1.8	1.7	1.6

(b) Having determined the cross sectional area of the round individual warm-air duct in square inches, the corresponding size of the round pipe may be obtained from Table 3.†

Section 4. Rectangular individual warm-air ducts. The dimensions of any rectangular duct section shall be the rectangular equivalent of the round pipe size determined according to paragraphs (a) and (b) of Article 2, Section 3. This rectangular equivalent may be obtained from Table 4.

Section 5. Round warm-air trunk line systems.

(a) Make a general diagram of the arrangement of all branches and trunks to connect all warm-air discharge rigisters with the heating unit, and calculate the area of each branch according to Article 2, Section 3, (a) and (b).

(b) Starting at the extreme end of the duct and working back toward the heating unit, the area of the most remote section of the trunk line shall be 10% less than the combined areas of the two or more branches joined together to form this part of the trunk. At the next junction of one or more branches with the trunk, the new trunk section shall be 10% less than the sum of the areas of the preceding trunk section plus the areas of the branches joining at this point.

(c) The area of the main duct at the heating unit shall in no case be less than 70% of the sum of all the branches from the main duct.

(d) Having determined the areas of all parts of the warm-air piping system, find from Table 3†, the diameter of round pipe for each section of the trunk duct.

Section 6. Rectangular duct warm-air trunk line systems.

†Not reproduced here. Table 3 is simply the areas of circles of various diameters and can be found in standard handbooks. For solving, when D equals the diameter in inches and A the area in square inches,

$$A = 0.7854\ D^2 \text{ and}$$

$$D = \sqrt{\frac{A}{.7854}}$$

(a) Proceed as directed in Article 2, Section 5, to design the system for round pipe trunks and branches.

(b) Change all sections of round pipe to the equivalent dimensions of rectangular ducts by means of Table 4.

Section 7. Wall Stacks. When a round branch connects to a rectangular wall stack, determine the dimensions of the stack and select the size as directed in Article 2, Section 4.

Section 8. Warm-air registers.

(a) When registers or grilles are placed below the breathing level, the net free area in square inches shall be not less than six times the room basic factor. This is for an air velocity through the free area of the register of approximately 300 f.p.m.

(b) When registers are placed in the wall more than 6 ft. above the floor, the net free area of the register in square inches shall be not less than four times the room basic factor. This is for a velocity of approximately 480 f.p.m. through the net free area of the register.

(c) Registers should be the approximate width of stacks or fittings to which they connect. Standard commercial sizes should be used when possible.

Section 9. Return air ducts.

(a) Return air ducts should be brought back from as many rooms as possible and care should be taken to withdraw from each room, or series of inter-communicating rooms, air equivalent to the amount delivered to the room or series of inter-communicating rooms.

(b) Sizes of either individual pipe or trunk line systems of return air ducts and stacks should be calculated on the same basis as warm-air supply ducts and stacks (Article 2, Sections 3 to 7, inclusive).

Section 10. Dampers. Each warm-air duct leaving the furnace in an individual duct system and each branch from any main trunk line in a trunk line system should be equipped with a damper having a substantial locking device. Return air ducts should be similarly equipped.

Article 3—Mechanical Equipment

Section 1. Furnace.

(a) Multiply the house basic factor from Article 2, Section 1, (f), by 1000. This gives the B.t.u. heat loss from the rooms heated. Divide this by 136 to obtain the Standard Code gravity rating of the furnace.

(b) If the furnace used is designed for gravity circulation, a well fitted and securely attached inner casing should be installed of a shape to conform to the shape of the furnace body and of such dimensions as to leave a free air space in square inches equal to approximately 0.45 times the total c.f.m. handled by the system. It should be so installed that air cannot pass between this inner casing and the regular outer casing of the furnace.

Section 2. Blower.

(a) The blower capacity in c.f.m. will be the sum of the c.f.m. required for all the rooms as determined in Article 2, Section 2, plus 15%, except that if this volume amounts to less than four changes or recirculations per hour, blower capacity should be increased to provide for four changes per hour.

(b) If the exact static pressure (Note 7) is not known, use the following values which meet average conditions:

Up to 1500 c.f.m., 1/8-in. water gauge
From 1500 c.f.m. up to 2000 c.f.m., 3/16-in. water gauge
From 2000 c.f.m. up to 3000 c.f.m., 1/4-in. water gauge
From 3000 c.f.m. up to 4000 c.f.m., 5/16-in. water gauge
From 4000 c.f.m. up to 5000 c.f.m., 3/8-in. water gauge

TABLE 4‡

EQUIVALENT ROUND AND RECTANGULAR DUCTS FOR EQUAL FRICTION

Side of Rect. Duct	2½	3	3½	4	4½	5	6	7	8	9	10
	Diameter of Equivalent Round Pipe										
8	4.7	5.2	5.7	6.1	6.5	6.9	7.6	8.2	8.8		
8½	4.9	5.4	5.9	6.3	6.7	7.1	7.8	8.5	9.1	9.6	
9	5.0	5.5	6.0	6.5	6.9	7.3	8.0	8.7	9.3	9.9	
9½	5.1	5.7	6.2	6.6	7.1	7.5	8.2	8.9	9.6	10.2	10.7
10	5.2	5.8	6.3	6.8	7.2	7.7	8.4	9.2	9.8	10.4	11.0
10½	5.4	5.9	6.5	7.0	7.4	7.8	8.6	9.4	10.0	10.7	11.3
11	5.5	6.0	6.6	7.1	7.6	8.0	8.8	9.6	10.2	10.9	11.5
11½	5.6	6.2	6.7	7.2	7.7	8.2	9.0	9.8	10.5	11.2	11.8
12	5.7	6.3	6.9	7.4	7.9	8.3	9.2	10.0	10.7	11.4	12.0
12½	5.8	6.4	7.0	7.5	8.0	8.5	9.4	10.2	10.9	11.6	12.2
13	5.9	6.5	7.1	7.7	8.2	8.7	9.6	10.4	11.1	11.8	12.5
13½	6.0	6.6	7.3	7.8	8.3	8.8	9.7	10.6	11.3	12.1	12.7
14	6.1	6.7	7.4	7.9	8.5	8.9	9.9	10.8	11.5	12.3	12.9
14½	6.2	6.8	7.5	8.1	8.6	9.1	10.1	11.0	11.7	12.5	13.2
15	6.3	6.9	7.6	8.2	8.7	9.2	10.2	11.1	11.9	12.7	13.4
15½	6.4	7.0	7.7	8.3	8.9	9.4	10.4	11.3	12.1	12.9	13.6
16		7.1	7.8	8.4	9.0	9.5	10.5	11.4	12.3	13.1	13.8
17		7.3	8.1	8.6	9.2	9.8	10.8	11.8	12.6	13.5	14.2
18			8.2	8.8	9.5	10.0	11.1	12.1	13.0	13.8	14.6
19				9.1	9.7	10.3	11.4	12.4	13.3	14.2	15.0

‡*Not reproduced in full. Extension of above table in larger sizes can be found in such handbooks as "Fan Engineering." The data are calculated from the formula*

$$D = 1.265 \sqrt[5]{\frac{(AB)^3}{A+B}}$$

where D equals the diameter in inches of the round pipe, and A and B are the sides in inches of the rectangular duct.

These allowances for static pressures apply when no washers or filters are used. If either or both are used, consult manufacturer for static pressure to be added to the above and order blower on this basis. For details of blower connections, locations, etc., consult manufacturer's catalog.

Section 3. Controls.

(a) An adjustable, automatic furnace switch should be placed in the bonnet of the furnace to start and stop the blower at predetermined temperatures. Under average conditions it should be set to start the blowers at from 130° to 175°, and to stop it at from 100° to 130°.

(b) A manual switch for summer control should be placed in the hallway, stairway or other accessible location, but should not be placed where it is liable to be turned by mistake. This switch should be so wired in conjunction with the automatic switch in the furnace casing that the blower cannot be stopped when the furnace is hot.

Note 1. In obtaining glass surface use full casement opening. An outside door is figured as glass.

Note 2. To obtain net outside wall, multiply height by width and deduct all windows and outside doors as obtained in Note 1. For all rooms with attic space immediately above, full ceiling areas shall be taken into account using Table A. Floors over unheated spaces shall be taken into account using Table A. For walls and doors between heated and unheated spaces, use 50% of similar outside exposure.

Note 3. The divisor 800 is for an estimated air change due to infiltration of outside air amounting to one room volume per hour and is generally used for rooms having one side exposed. For rooms having two sides exposed use divisor 600, which corresponds with 1.5 air changes per hour; for rooms having three sides exposed use divisor 400, which corresponds with two air changes per hour.

Note 4. (Not reproduced here. Shows derivation of formula. Not necessary for design.)

Note 5. If individual round pipes are used, it is common practice to use standard commercial sizes. If the calculated pipe area is not more than 10% greater than a standard commercial size, then the nearest commercial size may be used.

Note 6. In mechanical forced air heating systems the same sizes of basement pipes and wall stacks are used for all floors contrary to the Standard (gravity) Code because the velocity of air flow under the pressure influence of a blower is greater than the velocity produced by the aspirating effect of risers in a system operating by natural gravity circulation.

Note 7. Static pressure is the pressure (measured by water gauge) that must be exerted by the blower to overcome frictional resistance in the system and maintain proper air delivery.

How Cool? Inside Temperature Should Depend upon Type of Occupancy

By J. H. WALKER†

SUMMER cooling has progressed to a point where it is imperative that we carefully control the temperature and humidity. In the early stages, when any sort of real cooling was novel and immensely attractive to the public, it was sufficient to advertise that a theater or store was cooled. That time has passed.

There was a decided tendency in those early days to over-cool, and summer cooling was threatened with a real setback because of over-enthusiastic use. More recently, however, it has become recognized that to accomplish the purpose of attracting the public, a cooling system must produce a *moderate* amount of cooling effect and no more. The "70° inside" signs are apt to cause the prospective customer to shiver rather than to enter.

It must be recognized that there are two distinctly different kinds of occupancy to be considered, and the conditions to be maintained will be entirely dependent upon the kind of occupancy which exists. We may have continuous occupancy throughout the day, as in an office building, in which case the desirable inside temperature and humidity may be established and held, without regard to the outside temperature. The occupants, for the most part, enter the building before the outside temperature has risen in the morning, and they remain there most of the day. The problem of regulation in such buildings is relatively simple, once the optimum conditions have been determined and the summer comfort zone of the A.S.H.V.E. is without doubt dependable when properly applied[1].

Intermittent or short time occupancy, however, is characteristic of the store building, restaurant, and in fact probably the majority of buildings which are now cooled. In such buildings the dominating consideration is the intensity of the sensation of coolness which the occupant experiences upon entering and shortly after entering. Both temperature and humidity are involved and air motion as well. Their combined effect should produce a sensation of refreshing coolness—enough to continue during the customer's stay, but not enough to cause, initially or later, a feeling of chill. Thus the conditions should be governed by the average length of stay and with due regard for the prevailing outside conditions. Such conditions will not always produce maximum comfort for those who are in the building continuously, such as store clerks, but that is of course unavoidable.

A relationship between inside and outside conditions for short time occupancy is suggested in the A.S.H.V.E. *Guide* as follows:

Outdoor Temperature °F.	Indoor Air Conditions with Dew Point Constant at 57° F.		
Dry Bulb	Dry Bulb	Wet Bulb	Effective Temperature
95	80.0	65.0	73
90	78.0	64.5	72
85	76.5	64.0	71
80	75.0	63.5	70
75	73.5	63.0	69
70	72.0	62.5	68

Experimental Data

During the past summer an effort was made to obtain some confirming or disputing evidence as to the correctness of the above table in the sales offices of The Detroit Edison Company, to which people come to pay bills, purchase appliances and transact other business. The average length of stay is less than ten minutes. The systems were controlled according to the A.S.H.-V.E. recommendation and an attempt was made to find out the degree of comfort produced. Each customer, if circumstances permitted, was asked at the conclusion of the transaction how he or she liked the air conditions, and whether or not the temperature seemed about right. The answers were noted, with the exact time, so that the answers could be compared with the conditions prevailing at the time, as given by frequent wet- and dry-bulb readings. Thus a large number of votes were obtained. It is true that they were the offhand opinions of untrained observers and therefore somewhat inaccurate, but after all they were the impressions of the people whom the cooling systems were intended to please.

The results in one office are shown in Fig. 1. Each point represents one or more votes. The points indicate in code the customer's reaction while the coordinates of the chart show the inside effective temperature and the outside dry bulb.

A scientifically correct comparison would be between outside *effective temperature* and inside effective temperature. Outside effective temperature is rather troublesome to obtain, however, since it requires wet bulb readings and wind velocity measurements. Inside effective temperature is less difficult because the air movement is not a variable. Even here, however, the determination of effective temperature is beyond the ability of the operating talent that will usually be available. Therefore, a simpler criterion is the relationship between inside and outside *dry bulb* temperatures providing the humidity is controlled. When any system is once adjusted, there will be a certain range of relationship between temperature and humidity, and experience seems to indicate that although this zone is rather broad, it gives acceptable conditions.

Fig. 2 shows the relationship between outside dry bulb and inside dry bulb for the same days as Fig. 1 and with the same sense reactions plotted. In both of

†Superintendent of Central Heating, The Detroit Edison Company.

[1] "The Summer Comfort Zone," Yaglou and Drinker, Trans. A.S.H.-V.E., 1929.

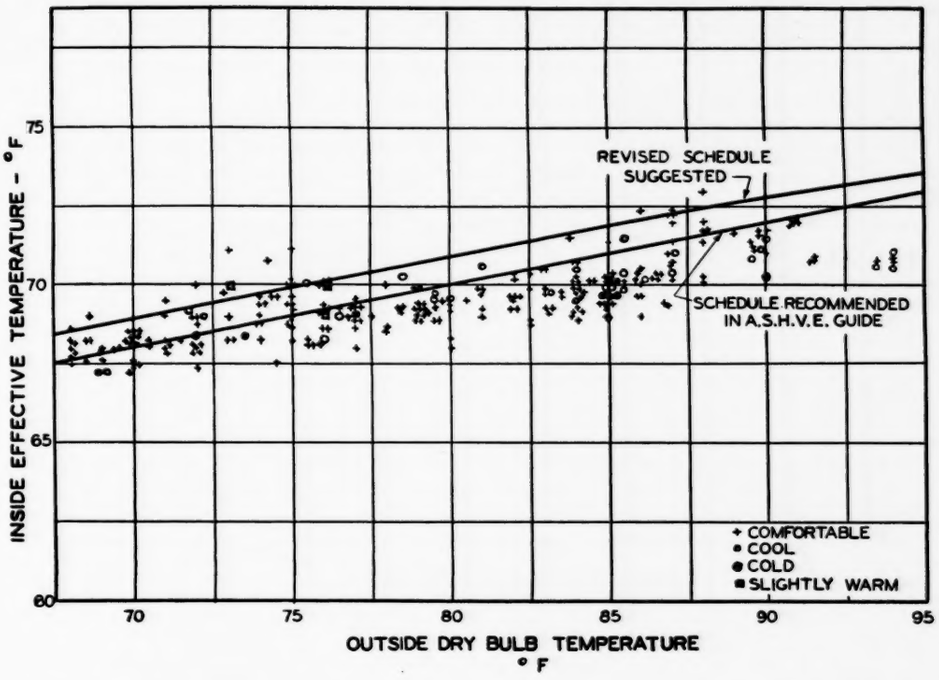


Fig. 1. Distribution of votes by customers showing their reaction as to their comfort, based on inside effective temperature.

these charts the A.S.H.V.E. line is shown, and the spread of the points indicates that the prescribed conditions were maintained with a fair degree of accuracy.

There are a few points which indicate conditions uncomfortable to the customer, some being too warm and others too cool, and the locations of the points on the chart rather consistently indicate that conditions were in general a little too cool and that the line should be shifted upward by about 1° dry bulb or about 1° E.T. In tabular form these revised conditions would be as follows:

Outdoor Temperature °F.	Indoor Conditions °F.	
Dry Bulb	Dry Bulb	Effective Temperature
95	80.5	73.5
90	79	73
85	77.5	72
80	76	71
75	74.5	70
70	73	69

Conclusions

While it is a mistake to draw too sweeping conclusions from this evidence it is probably correct to state that the A.S.H.V.E. schedule, slightly modified as above, gives satisfactory results for short time occupancy. It may be, however, that a much broader zone would be acceptable providing it were entirely above the A.S.H.V.E. line, for there is reason for thinking that an inside condition only *slightly* cooler than out of doors is so refreshing to a person entering that for a few minutes of occupancy it is all that is required. This point, however, needs further study.

Methods of Control

Obviously, in a small store it is impracticable to make frequent readjustments of temperature by hand control. Some form of automatic control is necessary. At least two types of differential thermostats are commercially available which will control the inside dry bulb in accordance with variations of outside dry bulb. Although the humidity variations are disregarded, such a method seems to give satisfactory results. A control of this kind has been in successful operation during the past summer, connected so as to start and stop the pump which circulates the cold water through the cooling coils.

One important point should be noted. At times when the outside temperature is falling rapidly it is utterly impossible to reduce the inside temperature fast enough to maintain the scheduled conditions; no cooling system of reasonable capacity could do so. Therefore at such times the schedule cannot be adhered to.

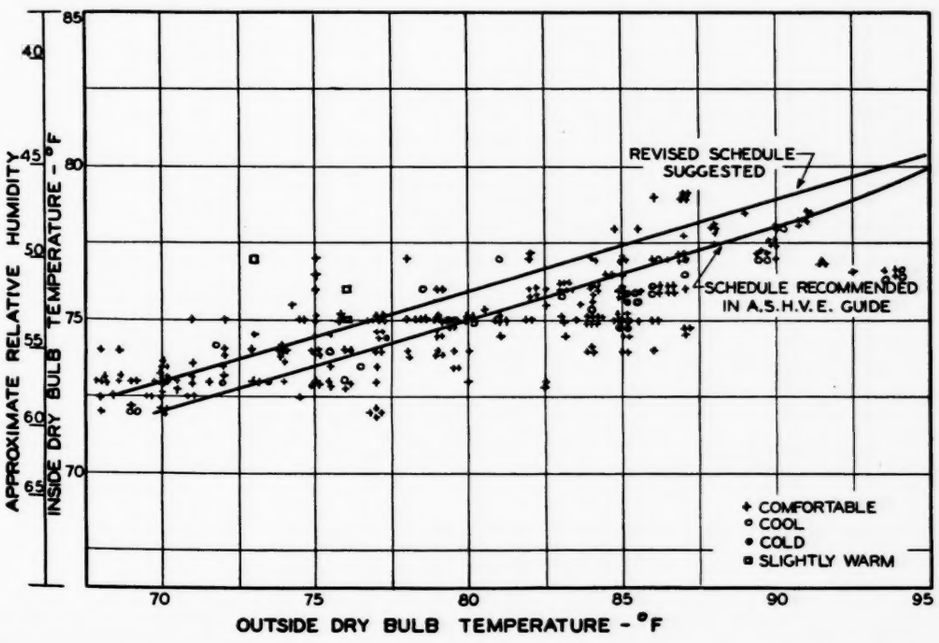


Fig. 2. Distribution of votes for same day as Fig. 1, based on inside dry bulb temperature.

Easy-to-Use Charts for Air Conditioning Problems

THE two graphs presented on this page are designed for the solution of some air conditioning problems without the use of the more elaborate—and more confusing—charts commonly used. They were prepared by R. P. Clarkson, Chief Engineer, Airtrol Division, J. H. McCormick & Company.

Fig. 1 gives the relative humidity directly when the dry bulb temperature and wet bulb depression are known. The vertical lines show the depression, the horizontal coordinates the dry bulb temperature, and the sloped lines the relative humidity. The shaded area is the comfort zone.

In Fig. 2 the curved lines indicate constant moisture content. Thus, the moisture content for a given dry bulb and relative humidity can be read directly. To determine initial or final conditions when heating or cooling with a dry surface with constant moisture content, the curves are followed. The five curves to the left are for pounds of vapor per pound of dry air at 70° dry bulb and 30%, 40%, 50%, 60% and 70% relative humidities. The first curve, therefore, shows directly that at 70° dry bulb and 30% relative humidity, 0.004734 lb. of water vapor is present per pound of dry air, and following along this curve we can find the relative humidity at any other dry bulb temperature when the same absolute amount of moisture is present.

Inasmuch as most calculations are based on a 70° final temperature, and the problem is how finally to arrive at that temperature and the given relative humidity, these curves are quite useful.

The two curves to the right show the amount of vapor at 90° dry bulb temperature and 45% and 60% relative humidity, respectively—a fair summer range. At the dewpoint these curves fall at approximately 66° and 75°, between which points will be found the temperatures of the city water in most localities. The shaded area shows the comfort zone with the line of maximum comfort indicated as the comfort line.

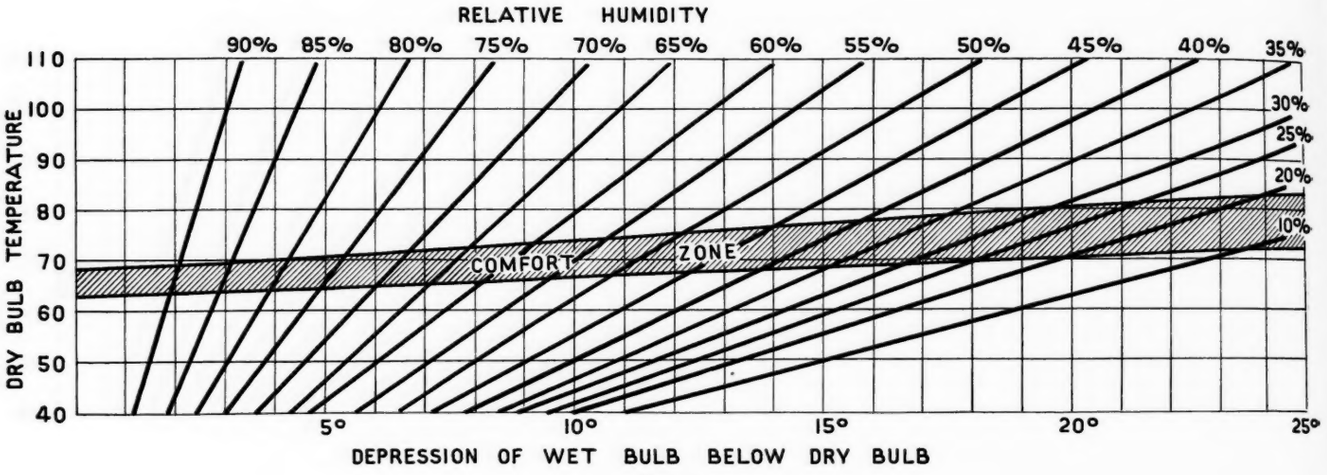


Fig. 1.

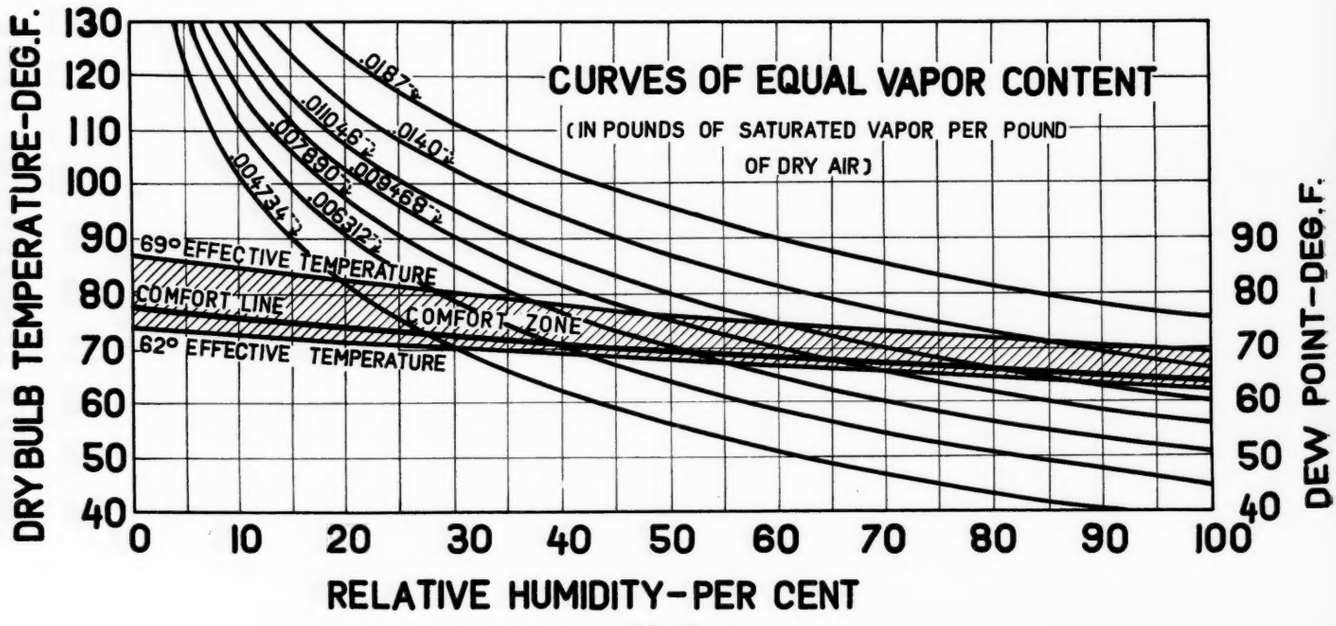


Fig. 2.

Cooling a Home by Air Circulation

By FRANK C. TAYLOR†

SOME years ago in Providence it was our custom during the hot days of summer, at the beginning of the day, to shut the blinds and close the windows to shut out the hot air. This system worked quite well. The air was cooler in the house than outdoors during the heat of the day, but was rather soggy, damp, and stagnant, and conditions were far from ideal. The theory, of course, was that the house cooled down at night and if the outside air was kept out the insulation would keep the inside of the house cooler than outdoors.

In my home in Rochester about three years ago I installed a fan in connection with the warm-air furnace and used the heat ducts of the heating system as ventilating ducts. During the hot days of summer, my practice is, in the evening when the temperature in the house is approximately the same as the outdoor temperature, to draw the air from outside by opening the damper to the outside duct and closing the damper between the fan and return grille and send the air through the ventilating ducts. During the night the house is, therefore, cooled down rapidly by the night air from the outdoors. In the morning when it begins to warm up, by a simple damper arrangement, I shut off the fresh air inlet by closing the outside damper, and by opening the return duct damper I recirculate the air in the house by drawing the air from inside the house through the return ducts of the heating system. During the warm hours of the day the air in the house is in constant motion, since it is being recirculated by the fan.

†Assistant Manager, Industrial Sales Dept., Rochester Gas and Electric Corp., Rochester, N. Y.

It may be rather surprising, but this system works. During the heat of the day the air in the house is between 8° and 13° cooler than the outdoor temperature and there is not that damp oppressive atmosphere found in the house closed up in the morning with no forced circulation of air.

The success of this system is due to the following facts: During the night the cool fresh air cools down the house more rapidly than by simply opening the windows; consequently, in the morning you start with a cooler house than would otherwise be the case. Even in an uninsulated house there is a decided temperature lag between the inside and outside air as the outside temperature rises. The air in the house in the morning is night air and as it warms up, the relative humidity decreases. The circulation of air by the fan system increases the evaporation from the body, and still further cools the occupants of the home.

An air filter installed on the delivery side of the fan cleans the air in the home during the day, and at night only allows clean air to enter when the air is taken from the outside.

The two charts show the temperatures inside and outside the home during three hot days in September, 1931. On September 13 the outside temperature was 93° at 3 p.m., while the inside temperature was 80°. The chart showing the outside temperature only indicates 90°, but anything above 90° is off the scale and 93° was the actual temperature given by an indicating thermometer. The four and one-half days shown on these charts were for an uninterrupted hot spell and, consequently, offered a severe test of the system.

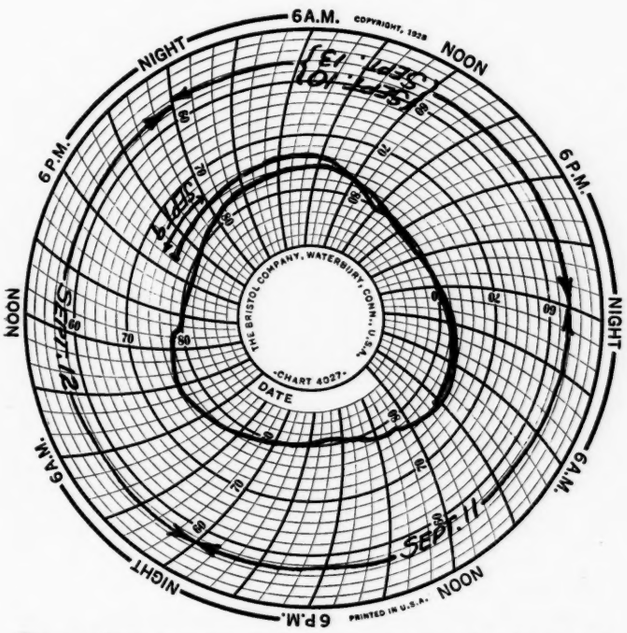


Fig. 1 Chart showing indoor temperatures for three hot days in home cooled by air movement

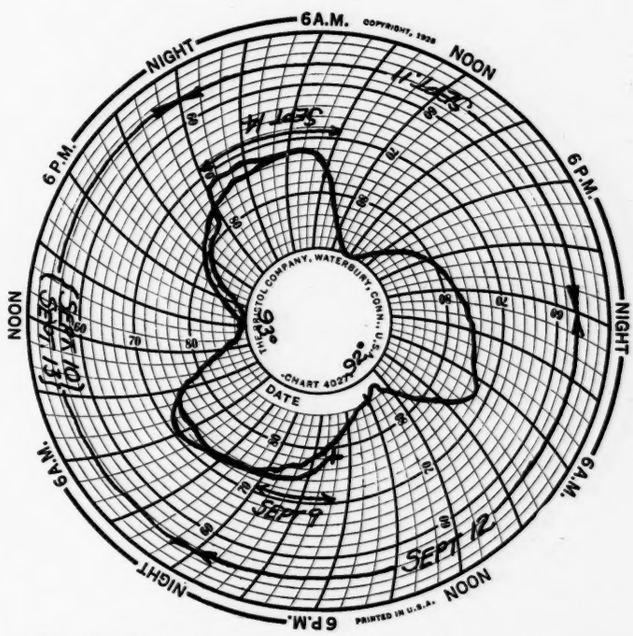


Fig. 2. Chart showing outdoor temperatures for same period covered by chart in Fig. 1.

News of the Month

American Radiator and Petro to Distribute Boiler-Burner Unit

American Radiator Company and Petroleum Heat & Power Company, both of New York, have announced that they will cooperate in marketing the Arco-Petro, a boiler-burner combination manufactured jointly by the two organizations. No modification of the corporate identities has been brought about by the arrangement. The product will be distributed through both Petro and Nokol dealers, and American Radiator Company heating contractors.

Standard Code for Mechanical Furnace Systems Available

The Tentative Code for the Installation of Mechanical Warm Air Furnace Heating Systems in Residences came off the press the middle of September and is ready for distribution, according to Allen W. Williams, managing director of the National Warm Air Heating Association, Columbus, Ohio. The code is being sold for 15 cents per copy, with reduced rates for quantity orders.

The new code was compiled by the joint code committee of the association and the code committee of the Furnace Blower Manufacturers' Association. The tentative rules are submitted with the idea of expressing their provisions in such form that they may be understood and applied by anyone, and are intended to serve until such time as a final and more precise code for mechanical warm-air furnace heating is evolved.

Railroad Car Air Conditioning Progresses

About 300 passenger cars operating on 24 American railroads at the present time are equipped with air conditioning apparatus. Of these, approximately 280 cars, owned by 18 roads, have provision for comfort cooling and humidity control. The Baltimore & Ohio Railroad leads with 112 conditioned cars. Fourteen on the Louisville and Nashville Railroad have air filters installed for the comfort of passengers, and five other railroads are operating at least one such car.

Eight New Distributors for Cook Electric

Cook Electric Co., Chicago, has appointed eight new representatives, as follows: I. S. Dane, Medford, Mass., J. F. Rodgers, Philadelphia, A. A. Aldridge, Erie, Pa., F. G. Herman, Oshkosh, Wis., J. D. Collins, Atlanta, Ga., S. W. Hetherington, Piqua, Ohio, E. D. Swanberg, Worthington, Minn., I. E. Danford, Caldwell, Ohio.

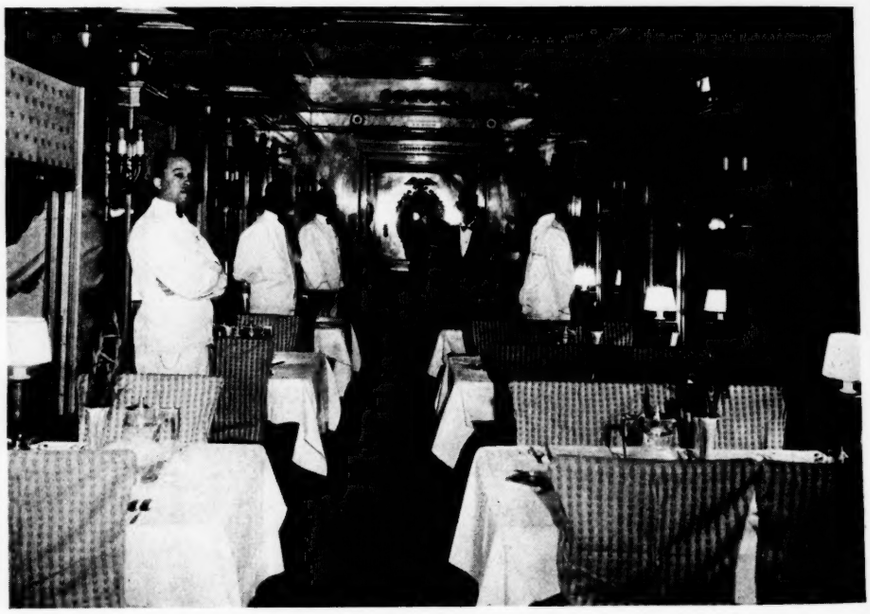
A. S. H. V. E. to Hold Annual Meeting in Cincinnati

Members of the American Society of Heating and Ventilating Engineers will be guests of the recently chartered Cincinnati chapter for the thirty-ninth annual meeting of the society, January 23-25, 1933. The committee on arrangements will consist of the following: W. C. Green, general chairman; H. N. Kitchell, vice-chairman; J. J. La Salvia, reception; E. B. Royer, registration; H. M. Rudio, entertainment; H. E. Sproull, banquet; R. B. Breneman, women's entertainment; I. B. Helburn, transportation; J. J. Braun, publicity, and C. J. Kiefer, finance.

K. A. Wright was recently elected president of the chapter, and H. M. Kitchell and G. B. Houliston are vice-president and secretary-treasurer, respectively. The board of governors consists of C. J. Kiefer and E. B. Royer.

Free Burner Service Dispute to be Arbitrated

In an effort to bring about a conclusion to the controversy over the matter of free servicing of oil burners in Washington, D. C., by the Standard Oil Company of New Jersey, that would be satisfactory to all parties to the dispute, a meeting was held in Washington, August 5, under the auspices of the American Oil Burner Association. Representatives of both sides presented evidence to Arthur W. Clark, managing secretary of the dealer division of the association, the oil company claiming loss of oil sales in the terri-



Air Conditioned Diner for "Yankee Clipper"

Dining cars on the "Yankee Clipper," operated daily between New York and Boston by the New Haven Railroad, have recently been equipped with air conditioning apparatus. Ice water is drawn from a bunker suspended beneath the cars and circulated through coils by means of motor-driven centrifugal pumps, and fresh air which is taken in through openings in the sides of the cars passes first through a filter and then across the ice water coils where it is both cooled and dehumidified. The air is then blown into the car through the seven nozzles seen over the doorway at the end. In winter the ice water coils will be connected with the steam lines, and warmed, humidified and filtered air will be supplied the cars.

tory due to arrangements made between oil burner dealers, who object to the gratis servicing, and other fuel oil distributors.

It is indicated that the problem which has proved troublesome for some time will be settled by negotiations.

Answers to Gas Competition Issued by A. O. B. A.

Outlining nine answers to nine competitive questions frequently met by oil burner salesmen, a booklet entitled "This Gas Competition" has just been released by the American Oil Burner Association. The book includes a formula for computing the comparative operating costs of the two fuels, together with some collateral material from reports of the gas association and elsewhere.

Drying Processes To Be Studied by A.S.M.E.

A paper on Classification of Drying, to include graphical analysis of air drying as developed abroad, by A. Weisselberg, consulting engineer, Charles W. Thomas, Raw Food Corporation, and T. R. Olive, assistant editor, *Chemical and Metallurgical Engineering*, is to be presented at a meeting sponsored by The American Society of Mechanical Engineers. The meeting scheduled for October 18, will be held in the Engineering Societies Building, 29 West 39th St., New York. The meeting will open at 7 p. m., and and all who are interested are urged to be present and take part in the discussion.

Tacoma Distributor for Kieley & Mueller

Kieley & Mueller, Inc., New York, has appointed F. G. Hartley Co., Perkins Building, Tacoma, Wash., as its representative in the Pacific Northwest.

Motor Wheel Appoints Sales Chief

Motor Wheel Corp., Lansing, Mich., announces the appointment of M. F. Cotes as sales director of its line of MW oil-burning utilities.

M. F. Cotes

Mr. Cotes was formerly president of the Draft-A-Justor Corporation, and since 1929 was president and active sales head of the Quaker Manufacturing Company.

A. S. H. V. E. Urges New Ventilation Standards

The American Society of Heating and Ventilating Engineers has requested that action be taken under the auspices of the American Standards Association to establish authoritative national standards for the ventilation of buildings. It is recommended that the association appoint a committee of engineers, architects, physicians, builders, health officials, and others, to investigate the subject exhaustively.

Taco Adds Humidifier

Taco Heaters, Inc., New York, recently announced the Taco humidifier, which will be built for them by the A. C. Gilbert Company under Standard Engineering Company patents. The new Taco humidifier will be merchandised and distributed in the same manner as the company's line of indirect water heaters.

A. S. H. V. E. Nominates New Officers and Council Members

W. T. Jones, Barnes & Jones, Boston, manufacturers of steam specialties, was named for president of the American Society of Heating and Ventilating Engineers in a report of the nominating committee at the June meeting of the A.S.H.V.E. Other officers nominated were C. V. Haynes, Philadelphia, first vice-president, and D. S. Boyden, Boston, secretary-treasurer. F. C. McIntosh, Pittsburgh, J. D. Cassell, Philadelphia, R. H. Carpenter, New York, and L. Walter Moon, St. Louis, were selected as new council members, to serve three years.

Bolles New Partner with Jaros & Baum

According to an announcement by Jaros & Baum, Frederick N. Bolles has been made a member of the firm, which will be known as Jaros, Baum & Bolles, consulting engineers. The firm will specialize in heating, plumbing and electrical equipment of buildings, with headquarters at 1350 Broadway, New York.

Seattle Representative for Davis Engineering

Davis Engineering Corp., New York, has appointed Fred W. Carlson, 959 Harrison St., Seattle, Wash., representative in that territory.

New Distributor for Penn Controls

Penn Electric Switch Co., Des Moines, Iowa, recently appointed E. W. Carr, Inc., 807 Howard St., New Orleans, La., as its representative in Louisiana and the southern half of Mississippi.

Department of Commerce Issues Modernizing Instructions

A tentative operating manual for conducting a local modernizing campaign has been prepared by the Committee on Reconditioning, Remodeling, and Modernizing, Department of Commerce, Washington. The publication is intended to assist cities and towns to stimulate business and employment, to help home owners maintain their property values by making needed improvements and repairs during periods of

News of the Month

prevailing low costs, and in general to promote community clean-up and beautification.

Information in the manual is based on a study of successful home modernizing campaigns conducted during the first half of the year in 65 cities in the United States which reported approximately $49 million worth of business and employment resulting directly from community improvement activities.

Automatic Products Opens Export Office

Automatic Products Co., Milwaukee, Wis., has opened an export office at 15 Laight St., New York, to facilitate the handling of all foreign orders.

Two new distributors have recently been appointed by this company: Fee and Stemwedel, Inc., 221 West Chicago Ave., Chicago, and Fagan and Andrews, 181 West Michigan St., Milwaukee.

Carrier Plans New Selling Program

Carrier Corp., Newark, N. J., is studying the question of sales of certain lines of products through dealers and distributors as part of a new sales program to take effect January 1, when it is planned to set up a single selling organization to handle several types of Carrier products, including those of Brunswick-Kroeschell Company, Carrier-York Corporation, Carrier-Lyle Corporation, and Carrier Engineering Corporation.

Certain of these products will be distributed through dealers and contractors where their application lends itself particularly to this method and where the equipment is sufficiently standardized to permit distribution in this way. While plans for the merchandising of such products are being developed, the larger central station type of air conditioning systems for office buildings, theaters, department stores, and public buildings involving special application engineering will be handled direct as heretofore through a contract installation department.

Electrol Sues Scott-Newcomb, Inc.

Electrol Incorporated, New York, has instituted suit against Scott-Newcomb, Inc., St. Louis, in which it is charged that the defendant company is not entitled to its corporate name, which has long been identified with products of the plaintiff corporation. The complainant also alleges that there has been a deliberate attempt on the part of Scott-Newcomb, Inc., to imitate in design and appearance the products of Electrol Incorporated so as to be deceptive to the public and to prospective purchasers. Electrol has also entered complaint before the Federal Trade Commission.

It is reported that Scott-Newcomb has filed a counter suit.

Westinghouse Lamp Co. Studies Ultraviolet in Daylight

Research investigations are being carried out in the laboratories of The Westinghouse Lamp Co., East Pittsburgh, Pa., to determine the intensity of ultraviolet radiation in daylight, and to study its effect upon agricultural and horticultural products.

Several types of meter have been devised, and by their use data are obtained from which the variations in intensity during the day are recorded. From this information, the effect of dust, clouds, and smoke on the amount of ultraviolet light in daylight can be determined. The influence of altitude, topography, and geographical location is also being studied.

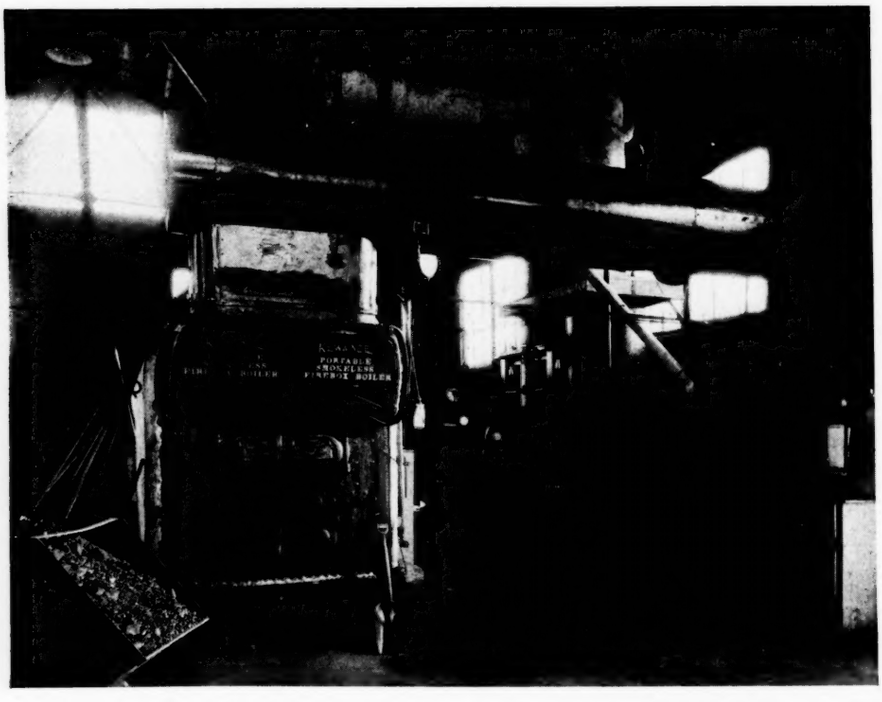
New G. E. Appointment for McLenegan

D. W. McLenegan has been appointed assistant engineer of the commercial engineering division of the General Electric air conditioning department.

Mr. McLenegan is a native of Milwaukee and a graduate of the University of Wisconsin, 1921.

Mechanics Honored by Rockefeller Center

Certificates of Superior Craftsmanship and gold buttons were awarded August 29 to George Mackemull, sheet metal worker, George Gerstenmaier, steamfitter, and Fred Dorzdacken, steamfitter's helper, for unusually meritorious skill in their work on the Sound Picture Theater of Rockefeller Center. Nineteen other mechanics of various trades were similarly honored.



Interior view of testing laboratory of the Kewanee Boiler Corp., Kewanee, Ill., showing one of the boilers set up complete with instruments and apparatus for testing purposes

H. H. Murdock, president of the New York Building Congress, made the awards.

New Distributors for Barber-Colman

Barber-Colman Co., Rockford, Ill., announces the appointment of Olson Brothers, 2612 Leavenworth Ave., Omaha, Neb., and Johnson Stoker Co., 407 State - Planters Building, Richmond, Va., as its distributors for temperature control equipment.

Stephen Price Moncrief

Stephen Price Moncrief, founder of The Moncrief Furnace Company, died in Atlanta, Ga., August 25.

Laurence F. Kent, who was elected president and general manager on Mr. Moncrief's retirement in 1926, will continue in charge of the company.

Isidor Weil

Isidor Weil, president of the Weil-McLain Co., Chicago, died September 2 at the age of 65.

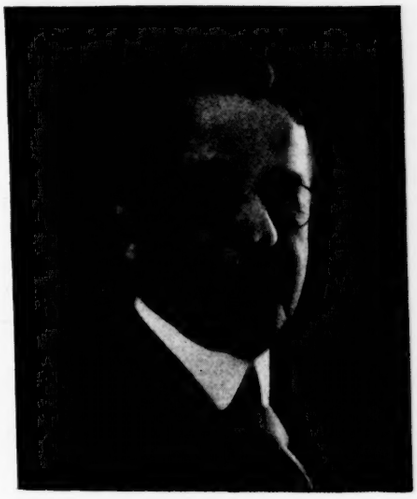
For more than 40 years Mr. Weil had been connected with the heating industry, having formed Weil Brothers, a wholesaling firm, in 1892. In 1918 Mr. Weil purchased control of the J. H. McLain Company, boiler manufacturer, and this company and Weil Brothers were dissolved and the Weil-McLain Company formed in 1920.

George D. Hoffman

The heating industry will learn with sincere regret of the death, September 5, of George D. Hoffman, 74, president of the Hoffman Specialty Company, Inc., at his home in Pasadena, Calif.

Mr. Hoffman was born in Chicago, educated as a heating engineer and associated all his life with the heating industry. He perfected and patented the Hoffman air valve, and in 1913 organized his own company for the manufacture of these valves and other heating specialties.

Although always keenly interested and in touch with the affairs of his company, Mr. Hoffman has for some years lived in Pasadena, where he was principally engaged in developing an electrical heating appliance and marketing it on the West Coast.



George D. Hoffman

The present executives of the Hoffman Specialty Company, Inc., will continue its management on the same policies originally laid down by its founder.

Buffalo Forge Co., Buffalo, N. Y., has published a bulletin describing the Buffalo Limit Load Conoidal fans. Contains dimensional data and characteristics of fans. Twenty-three pages, standard size.

COMING EVENTS

OCTOBER 3-7, 1932. Twelfth Fall Meeting of the American Welding Society, to be held in the Statler Hotel, Buffalo, N. Y.

OCTOBER 10-12, 1932. Fourteenth Annual Convention of the American Gas Association, to be held in Atlantic City, N. J.

OCTOBER 24-27, 1932. Sixty-First Annual Conference of the American Public Health Association, to be held in Washington, D. C.

NOVEMBER 30-DECEMBER 4, 1932. Annual Meeting of the American Society of Mechanical Engineers, to be held in the Engineering Societies Building, New York.

DECEMBER 5-10, 1932. Tenth National Exposition of Power and Mechanical Engineering, to be held at the Grand Central Palace, New York.

DECEMBER 7-10, 1932. Twenty-Eighth Annual Meeting of the American Society of Refrigerating Engineers, to be held in New York.

JANUARY 23-25, 1933. Thirty-Ninth Annual Meeting of the American Society of Heating and Ventilating Engineers, to be held in Cincinnati, Ohio.

JUNE 12-17, 1933. Tenth Annual Convention of the American Oil Burner Association, to be held in Chicago. Headquarters at the Hotel Stevens.

News of the Month

American Gas Products Corp., Division of American Radiator Co., New York, has published a manual on hot water supply in which is presented detailed information regarding the solution of problems dealing with gas goiler requirements and the necessary control for automatic large volume hot water supply systems.

A. M. Byers Co., Pittsburgh, Pa., has issued a four-page folder, "The Welding of Genuine Wrought Iron." Contains information on welding procedure and engineering data on properties and characteristics of wrought iron.

American Radiator Co., New York, has published two catalogs on Arco radiator enclosures. "The Radiator Goes Modern," a 20-page booklet in which installations are illustrated is intended for consumer use. "Arco Radiator Enclosures" contains drawings and data of a technical nature for architects, builders, and heating contractors.

The Triumph Electric Corp., Cincinnati, Ohio, has compiled a convenient table of motor characteristics for use in specifying correct types of motors for various applications. It may also be used in checking performance of old installations for the purpose of reducing connected load and raising power and load factor.

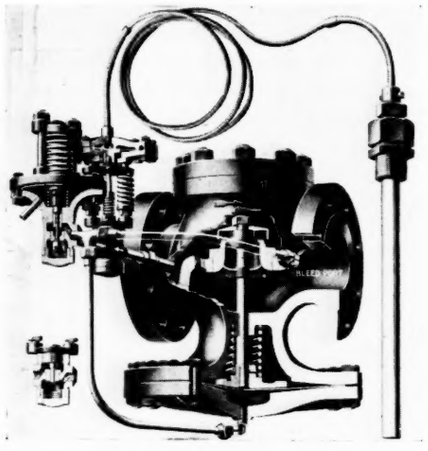
Toridheet Division, Cleveland Steel Products Corp., Cleveland, announces the appointment of the following as its dealers: New Haven Toridheet Co., New Haven, Conn., J. L. Larson, Sandwich, Ill., Allied Oil & Burner Co., Cleveland, Mike Kubisiak, Wisconsin Rapids, Wis., Gunther Hardware Co., Quincy, Ill., Little & Haggarty, Inc., Derby, Conn., General Oil Burner Service Co., Norwood, Mass., Universal Oil Burner Co., Nyack, N. Y., and R. C. Weik, Bristol, Pa.

The Foxboro Co., Foxboro, Mass., has published Bulletin 177, Temperature Controllers. Contains engineering information and data, and includes sections devoted to bulbs, charts, valves, and accessories. Illustrated, standard size, 48 pages.

New Equipment

Temperature Regulator Provides Protection Against Excessive Pressures

Spence Engineering Company, Inc., 110 East 42nd St., New York, has announced the Type ETD combined temperature and pressure regulator for controlling the flow of fluid to a heating or cooling element so as to maintain a constant, adjustable, predetermined temperature, and at the same time protect the coils against excessive pressure.



Spence Type ETD Temperature and pressure regulator

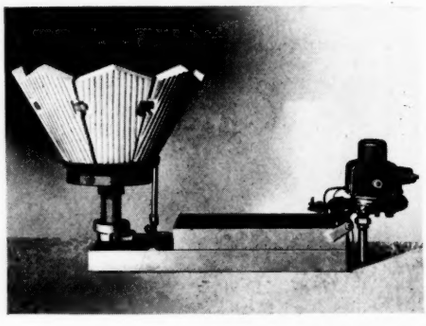
Regulator is self-contained and is operated by the fluid it is controlling. The main valve is normally closed. A spring normally holds the pressure pilot open, and the natural position of the thermostatically-operated temperature pilot is also open. This allows the initial pressure to flow past the two pilots faster than it can escape through a bleedport opening into the main, causing an increase in pressure on the under side of the main valve diaphragm thereby forcing the main valve open. When the temperature reaches the setting of the thermostat, the temperature pilot closes, permitting the pressure to escape through the bleedport and allowing the main valve to close. A delivery pressure greater than that for which the pressure pilot is set will close the pressure pilot, closing the main valve in a similar manner. Therefore, if either pilot closes, the main valve is closed, but the pressure pilot will not operate unless the pressure on the element exceeds a predetermined setting so that control is primarily by temperature.

A pressure of 1 lb. or more is sufficient to operate the regulator. The manufacturer states that in actual operation, except when correcting for sudden changes, the action is very gradual so that the regulator floats on the line holding the temperature constant. Regulators are built with cast iron bodies for pressures up to 250 lb., 450°, and with cast steel bodies for pressures up to 400 lb., 750°. Sizes range from ½ in. to 12 in.

High-Low Gas Valve Prevents Stratification

H. M. Sheer Co., Quincy, Ill., has announced the Type 60-A High-Low motor gas valve, which is used in conjunction with two room thermostats to regulate the operation of a gas burner to high or low flame to prevent stratification of the air in the living quarters.

One thermostat is located at the customary breathing line height, and the other near the floor line. The breathing line thermostat controls the full flame, and the lower thermostat controls the low flame. The two circuits operate independently although the full flame circuit may be termed the "master circuit" since, when the breathing line thermostat calls for heat, all other circuits are broken and the full flame is turned on. The lower thermostat is set several degrees lower than the breathing line thermostat, and it will cause the valve to open to the low flame position whenever the air temperature drops below a comfortable point due to stratification after the full flame has been turned off.

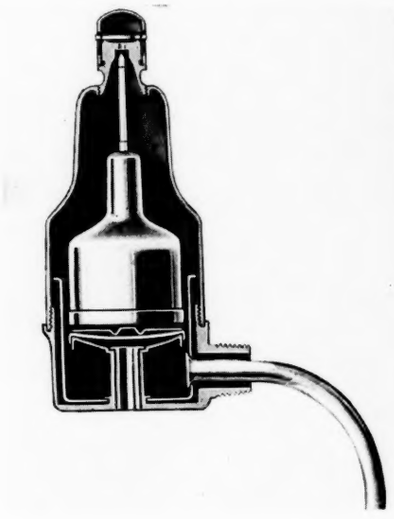


Sheer motor gas valve on burner

Air Valve Has Double Vacuum Seal

Hoffman Specialty Co., Inc., Waterbury, Conn., has announced the No. 77 vacuum radiator air valve designed for one-pipe steam heating plants.

A double vacuum air lock is incorporated, the check at the top acting as the vacuum starter in a half hot radiator, and the vacuum diaphragm constituting the main lock that closes the port and exerts a pressure 20 times greater than a check. The valve is of all-metal, double shell construction. Base and ⅛ in. nipple connection is a one-piece brass forging, and valve-pin is a non-corrosive nickel-silver alloy. Maximum operating pressure is 10 lb.



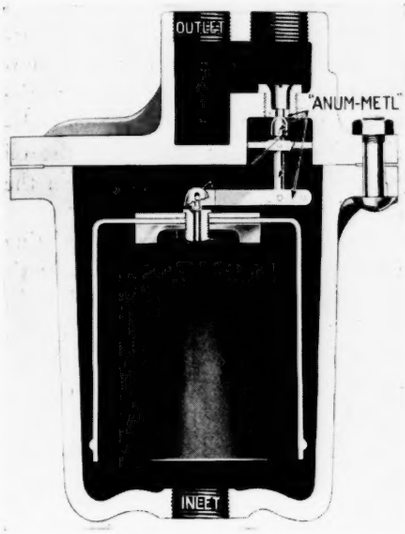
Hoffman No. 77 vacuum valve

Steam Trap Has Anti-Balancing Device

Tendency to balance or dribble has practically been eliminated in the Strong No. 20 Series inverted bucket steam traps is the claim of the manufacturer, The Strong, Carlisle & Hammond Co., 1392 West Third St., Cleveland.

This is accomplished by means of a valve arrangement in the operating lever which provides a constant small opening to allow the air and other gases to escape from the bucket while the trap is filling. When the trap reaches the point of discharge where balancing usually occurs, the larger valve is automatically opened, permitting a quantity of air to escape suddenly from the bucket and sufficient water to enter the bucket to overbalance it and open the main discharge valve.

Moving parts are made of Anum-Metl, a hard and long-wearing alloy. Traps are made in six sizes, from 2400 sq. ft. to 54,000 sq. ft. of radiation, with capacities ranging from 800 lb. to 18,000 lb. of water discharged per hour at 125 lb. pressure at the seat. Forged steel traps, equipped with monel inlet strainer and anti-balancing device, are available for higher working pressures.



Strong No. 20 Series trap with anti-balancing device

Device Detects Refrigerant Leaks

Turner Halide Detector is the name applied to a device manufactured by The Turner Brass Works, Sycamore, Ill., for locating leaks in refrigerating systems using chlorinated hydrocarbon refrigerants. These include methyl chloride, ethyl chloride, trichlore-ethylene, methylene chloride, and F-12.

An alcohol blow torch, having a burner housing of special design, syphons its air supply through a flexible rubber tube. If the open end of the tube is held in proximity to a leaky joint, the gas is syphoned through, and on striking the burner the color of the flame is changed from blue to green. The manufacturer states that detection is rapid and positive, and that leaks from which gas was escaping at a rate equivalent to a loss of approximately 1 lb. of refrigerant in seven and one-half years have been detected under tests. The detector also possesses utility as a blow torch for general service work.

Handy Ozonator

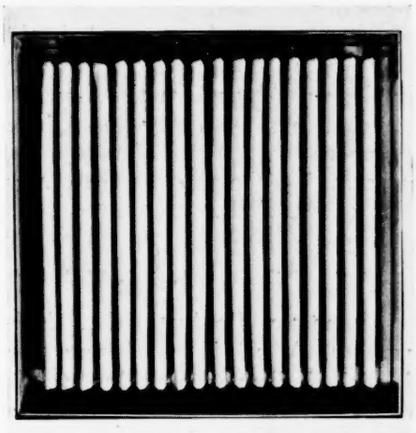
Interstate Electric Co., 4339 Duncan Ave., St. Louis, Mo., is manufacturing the Handy ozonator. The device passes the air from the room through an ozone generator and then delivers the ozone-charged air back into the room. It is said by the manufacturer to oxidize the impurities in the air, thereby eliminating objectionable odors and imparting invigorating qualities to it.

Units may be had enclosed in the compact standard case, or in an ornamental brass lacquered case. The ozonator can be regulated with a rheostat or switch, so that the ozone delivered can be adjusted to suit the conditions.

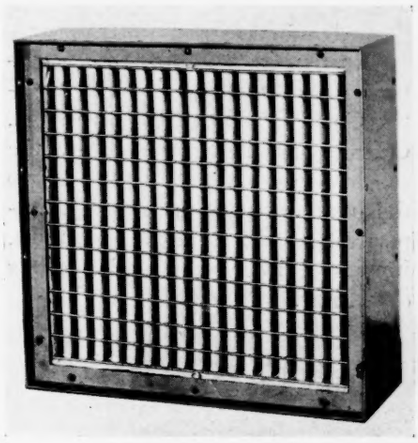
Annis Dry Air Filter Units

Coppus Engineering Corp., Worcester, Mass., is manufacturing the Annis Type FU dry unit air filter for ventilating and air conditioning systems.

Filter element consists of an all-wool felt glove placed over an electrically welded and rustproofed wire frame, supported in a sheet metal casing. The element is held in place by a spreader grid which draws the individual pockets tightly over the wire frame and seals the edges against leakage. Units may be assembled in any combination arrangement desired to secure the required capacity.



Air intake side of Annis filter



Clean air side

Filters are easily cleaned by means of a small vacuum cleaner supplied with each installation. The manufacturer states that the capacity and air resistance of the filter are affected very little by dampness or oily atmosphere.

Units are 20 in. wide by 20 in. high, and the depth is 6½ in. Each unit has a capacity of 1000 c.f.m. with a resistance to air flow of ¼ in. of water. The weight of the assembly is 25 lb. An efficiency of 100% in the removal of dust from air is claimed by the manufacturer.

Motor Windings Shielded from Cooling Air

Reliance Electric & Engineering Co., 1042 Ivanhoe Road, Cleveland, has announced the Type AA Form F fully enclosed fan-cooled induction motor. The manufacturer recommends these motors for use in locations where motors are exposed to dirt, iron dust, moisture, or injurious fumes.

Cooling air is drawn in by a fan

at the front end, carried over the outside of the heated portions and out through the back end shield without coming in contact with the windings. The winding shields, with the end shields, form a dust-tight enclosure for the stator windings and rotor.

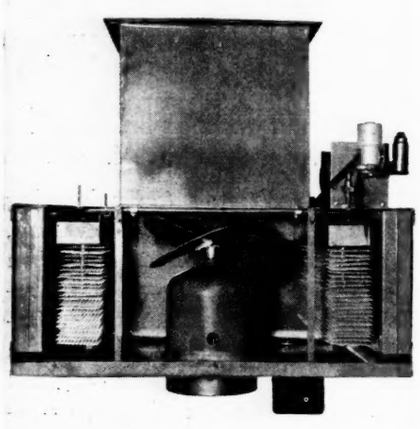
Insulation Treated To Prevent Damage by Dry-Rot

Construction and insulating materials manufactured by The Celotex Co., 919 North Michigan Ave., Chicago, are being treated by the Ferox process which, according to the manufacturer, renders it impervious to the attacks of termites, fungi, and other cellulose-destroying organisms.

G. E. Announces Filter and Humidifier

General Electric Co., Schenectady, N. Y., has announced the Humifilter, a device for circulating, filtering, and controlling the humidity of air in dwellings.

Unit is installed suspended beneath the lower floor. An elastically-mounted fan, driven by a small motor, draws air from the basement into the device where it is passed through filters, humidified, and discharged into the rooms above through a floor grille. The air is brought back to the basement through a return grille in the far side of the house.

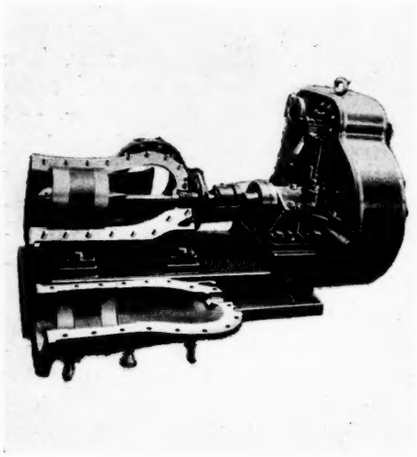


General Electric Humifilter

Steam supplied from an existing heating boiler is used to heat the water for humidification and rate of evaporation is controlled by a humidistat. The manufacturer states that the unit is capable of supplying sufficient moisture to homes not exceeding 50,000 cu. ft. in volume, and a filtering capacity adequate for about 15,000 cu. ft.

Propeller Type Pump for Direct Connection

De Laval Steam Turbine Co., Trenton, N. J., is manufacturing a propeller type pump for handling relatively large volumes of liquid against comparatively low heads. This type of pump can be operated at high rotative speeds, and can be direct connected to a standard speed electric motor or steam turbine.

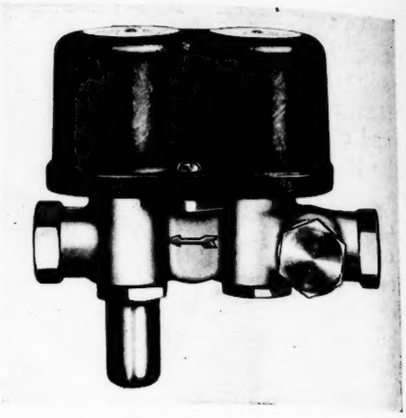


De Laval propeller type pump

Propeller is designed for the specific conditions of capacity, head, and speed, and is finished on all surfaces. The casing around the propeller is protected by a separate sleeve which can be renewed should wear occur. This sleeve supports guide vanes by which the liquid is directed in smooth flow-lines. The pump casing consists of two parts, separated in the plane of the center line of the shaft.

Twin Oil Regulating Valve

Automatic Products Co., Milwaukee, Wis., is marketing the Model 77 Duplex oil valve, which combines two solenoid valves, a metering valve and a strainer into a single unit.



Duplex oil valve

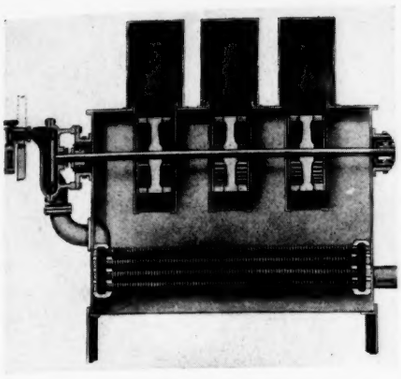
Operation is the same as if there were two separate valves connected together. A constant current is required to energize the coils and raise the valves from the seats, and both valves must be raised simultaneously. Any interruption of power supply permits the valves to drop to the closed position. The valve is so designed that the pressure of the oil assists in holding the valves in the closed position.

Plungers are of corrosion-resisting material, and the valve is of a hard-surfaced stainless alloy. A 45-mesh strainer is located at the inlet side, assuring protection of the valve parts. Strainer, metering device, and valve seats are readily removable for inspection and cleaning. The body is constructed of bronze.

Pipe connections are 3/8 in. and the port diameter is 3/32 in. The standard model is regularly furnished for 110 volts at 60 cycles, and the power consumption is approximately 20 watts. The maximum operating pressure at the rated voltage is 30 lb. per sq. in., and the capacity ranges between 6 gal. and 12 gal. per hr., when operating at heads ranging between 12 in. and 48 in.

Unit Heater Fan Driven by Steam Turbine

A line of unit heaters equipped with turbine-driven fans has been announced by Murray Iron Works Co., Burlington, Iowa. Murray unit heaters are made in either the cabinet type or the ceiling type, and are for industrial application. These heaters may also be furnished with the usual electric motor drive, or as duplex units with both turbine and



Murray cabinet type unit heater

motor to permit operation as ventilating fans.

Turbine-driven fans will operate on steam pressures as low as 12 lb. Approximately two-thirds of the steam passes through the turbine before entering the heater coils, where it is condensed at atmospheric pressure. The manufacturer mentions as advantages for the turbine drive the saving of power, the elimination of wiring and electrical equipment, independence of electric power interruption, possibility of operation at unlimited variety of speeds, and elimination of fire hazard due to sparking or defective wiring.

Steam is admitted to the heater through a nickel cast iron header into which are expanded several banks of heavy copper tubes provided with brass radiating fins attached to their exteriors. The entire assembly is enclosed in a substantial sheet metal box. Thermostatic valves and switches are furnished when desired.

Ceiling and cabinet types are each made in two sizes, ranging in capacity from 105 sq. ft. of equivalent direct steam radiation to 2400 sq. ft. of radiation.

Grinnell Welding Fittings

Grinnell Co., Inc., 277 West Exchange St., Providence, R. I., is manufacturing a line of welding fittings which includes elbows and returns, and outlets for either welded or threaded pipe.

Elbows and returns are made from seamless steel tubing having a uniform wall thickness outside and inside equal to that of steel pipe of the corresponding size. Fittings can be cut on the job, straight across the pipe to any desired angle, and simple or compound bends to meet any requirement can be readily made up by a combination of two or more fittings.

Standard weight long turn fittings are available in pipe sizes from ¾ in. to 18 in. outside diameter inclusive. Extra heavy long turn fittings are made in pipe sizes from 1½ in. to 18 in. outside diameter inclusive. Short turn 90° elbows and 180° returns are made only in standard weight in sizes from 2 in. to 20 in. outside inclusive. Long turn elbows and returns have radii equal to one and one-half times the nominal pipe size. Short turn fittings up to 14 in. have radii equal to the nominal pipe sizes. Larger sizes have radii approximately equal to the pipe diameters.

Grinnell welding outlets and

Grinnell welding bends and outlets

threaded outlets are stock fittings designed for pipe welding where it is necessary to make branch connections. They can be used with tees, side outlet tees, crosses, etc. Heavy external reinforcements provide strength and dissipate the excess heat during the process of welding, preventing shrinkage and distortion. Wide bases are correctly shaped to fit the pipe, resist bending stresses and provide funnel shaped inlets which reduce friction.

Aluminum Bolt Anchor

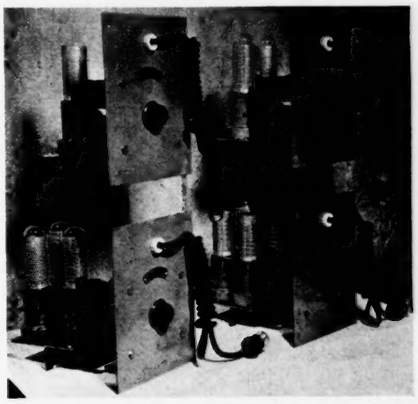
Rawl-Anchor is the name given to a one-piece expanding masonry anchor for bolts recently announced by The Rawlplug Co., Inc., 98 Lafayette St., New York.

A double inverted cone body of aluminum is employed as the expanding member, imparting a high degree of holding power. It is recommended by its manufacturer as being extremely simple to install. Either end is inserted in the hole and when properly caulked at a sufficient depth the ductile aluminum collars top and bottom spread, sealing the hole and preventing the lead from flowing under load pull. The bolt head imbeds itself in the aluminum collar when caulked, and cannot turn in the hole.

Electrozone Ozone Generator

An ozone generator, designated the Type M Electrozone ozonizer and ionizer, has been developed by The Air Conditioning & Engineering Co., 2914 S. Jefferson Ave., St. Louis, Mo. The device is intended for domestic air conditioning application.

Unit is installed in the air passage of the ventilating system or in the cold air duct of a recirculating warm-air heating system, for which purpose a 6 in. x 8 in. hole is cut. Four sheet metal screws mount the device on the duct, and connection is made to the lighting circuit by means of a cord and plug. Ozone is generated by ionization of oxygen produced by an electrical brush discharge from screen grid type gas-filled tubes.



Four sizes of Electrozone ozonizer

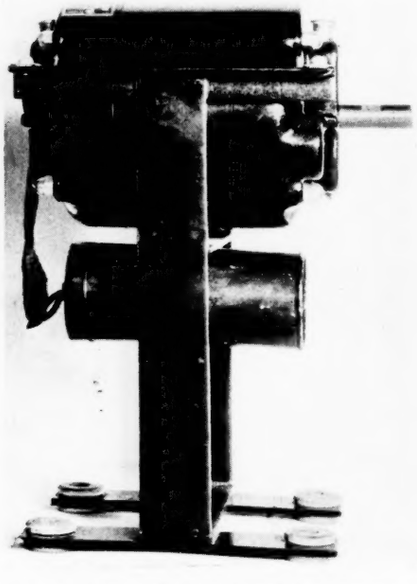
New Equipment

Ozone output is regulated by adjustment of a rheostat. It is said that odors arising from tobacco smoke, cooking, and other characteristic household odors are eliminated and the air revitalized without a perceptible presence of ozone. Units are available in sizes having from one to four tubes, and larger sizes can be secured.

Motor Developed for Air Conditioning Work

Fractional horsepower motors, designed especially for oil burner drive and air conditioning work are being manufactured to specification by The Ohio Electric Mfg. Co., 5900 Maurice Ave., Cleveland. Extreme care is exercised in the design and production of these motors to secure quiet operation.

Half-inch sleeve bearings are ground to a push fit in the motor frame and end bell and reamed. After the bearing is reamed almost to size, a tool is pushed through the bearing which accurately sizes the bearing to a clearance of 0.0005 in. and hardens and polishes the surface. Used with an accurately ground shaft, the bearing has a long life and if properly lubricated will not slap, according to the manufacturer.



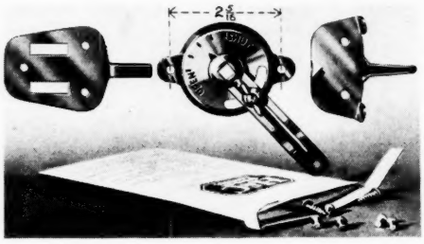
Ohio Electric fractional horsepower motor

Motors can be supplied for either alternating or direct current, and for constant or variable speed operation. All designs incorporate recirculating lubricating oil features for the bearings, spring space washers to prevent slapping of the rotor, and cushion mountings. Where the motors are used with propeller type fans thrust bearings are incorporated. For constant speed types continuous condensers are recommended, eliminating the necessity for centrifugal cut-out switches.

Damper Regulator and Dial

Hart & Cooley Mfg., Co., 61 West Kinzie St., Chicago, is marketing a damper regulator set, designated No. 70¼. A dial shows the relative position of the damper, and a wing nut retains the setting at any desired opening.

Regulator with the two bearings on which the damper swings, together with the rivets and screws necessary for installation are all packed complete in one carton. The device is cadmium-plated.

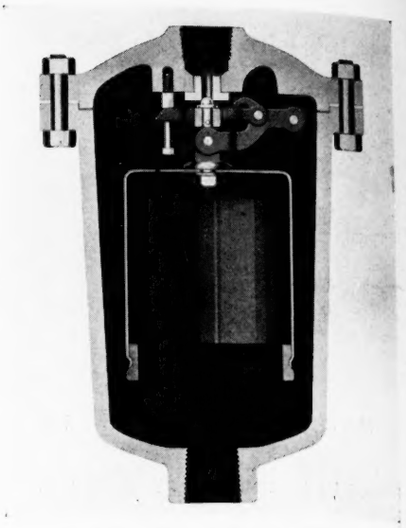


Damper regulator

Swartwout Inverted Bucket Traps

An inverted bucket type steam trap is being marketed by The Swartwout Co., 18511 Euclid Ave., Cleveland.

Air and steam entering at the bottom are trapped in the bucket displacing the water and the resulting buoyancy actuates the linkage to close the discharge valve. Air escapes through a small vent hole in the top of the bucket and collects at the top of the casing from which it will be discharged when the valve is opened. Steam also escapes through this opening and is condensed in the water. As water displaces the air and steam in the bucket, the bucket loses its buoyancy and the valve is opened as it sinks. As long as condensate continues to enter the trap at the bottom, the bucket remains down and allows the water to pass the valve at the same rate at which it enters. As steam and air follow the water, the bucket rises to close the valve, and the cycle is repeated.



Sectional view of trap

Valve disc and seat are of hardened stainless steel, and the bucket is of one-piece spun copper. Valve-operating mechanism is so designed as to provide sufficient leverage to crack the valve against the pressure within the trap. As soon as the disc is cracked from its seat a kicker on the bucket lever strikes the valve lever and forces the disc and lever clear of the opening. Traps are available with connections for pipe sizes ranging between ½ in. and 2 in.

Fractional Horsepower Motors Redesigned

A new line of fractional horsepower motors has been developed by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. First of the new motors to be put into production is the capacitor type, used in oil burners, stokers, and refrigerators; and all types of small motors generally used in household appliances, fans and blowers, air conditioners, unit heaters, and similar uses will be affected by the redesign.

An improved type of resilient spring mounting will be a feature of the new motors.

37,000,000 cubic feet

-largest commercial building on the Atlantic seaboard

INLAND TERMINAL No. 1
Port of New York Authority
New York City

In this great warehouse, with its acres of floor space, its multiform goods to protect and to handle efficiently, and its millions of dollars invested—here where durability enters so directly into profits, NATIONAL was used for the major pipe tonnage. As additional protection against corrosion the well-known NATIONAL Scale Free Pipe was used for the smaller sizes of heating and sprinkler lines and NATIONAL Rust Resisting Copper-Steel Pipe for rain leaders and drains which are constantly subject to atmospheric corrosion.

Not on sentiment or fancy, but on mature judgment, backed by technical findings and practical knowledge, as to what pipe would result in maximum service and satisfaction at minimum cost, was this selection made. Thus, from one source and another, confirmation is given of the outstanding value of NATIONAL—

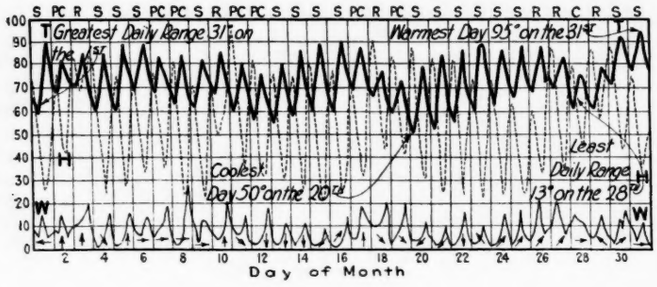
America's Standard Wrought Pipe

NATIONAL TUBE COMPANY
Subsidiary of
United States Steel Corporation
Pittsburgh, Pa.

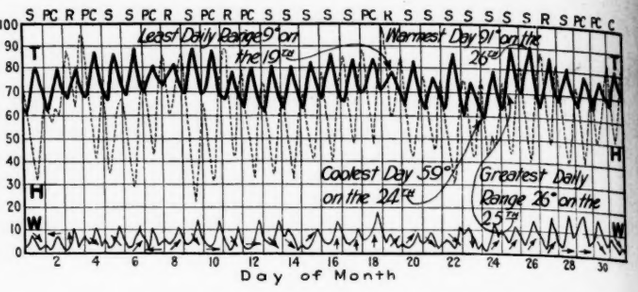
NATIONAL PIPE

The Weather

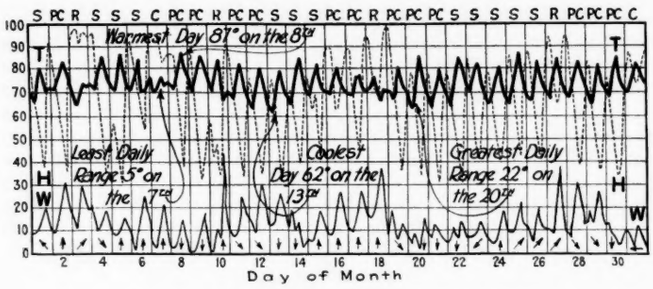
August, 1932


Greatest Daily Range 31° on the 13th
Warmest Day 95° on the 31st
Coolest Day 50° on the 20th
Least Daily Range 13° on the 28th
Day of Month

Pittsburgh

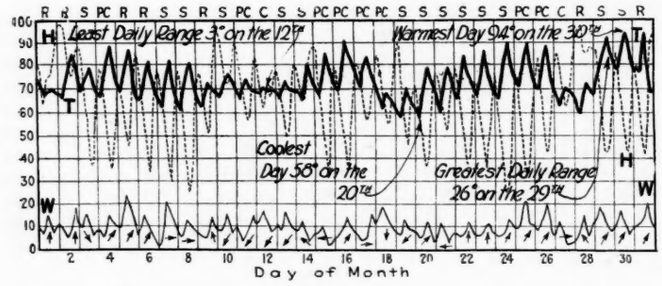

Least Daily Range 9° on the 19th
Warmest Day 91° on the 26th
Coolest Day 59° on the 24th
Greatest Daily Range 26° on the 25th
Day of Month

Boston

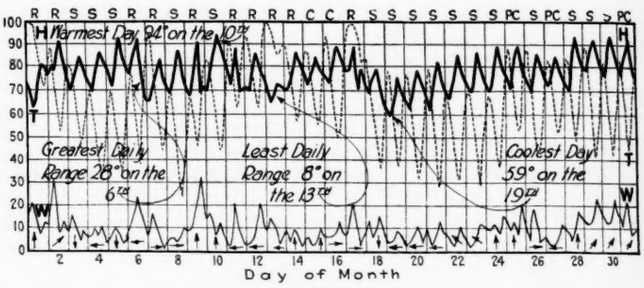

Warmest Day 87° on the 8th
Least Daily Range 5° on the 7th
Coolest Day 62° on the 13th
Greatest Daily Range 22° on the 20th
Day of Month

New York

(Hourly observation of the Relative Humidity Plotted on this Chart)


Least Daily Range 3° on the 12th
Warmest Day 94° on the 30th
Coolest Day 58° on the 20th
Greatest Daily Range 26° on the 29th
Day of Month

Chicago


Warmest Day 94° on the 10th
Greatest Daily Range 28° on the 6th
Least Daily Range 8° on the 13th
Coolest Day 59° on the 19th
Day of Month

St. Louis

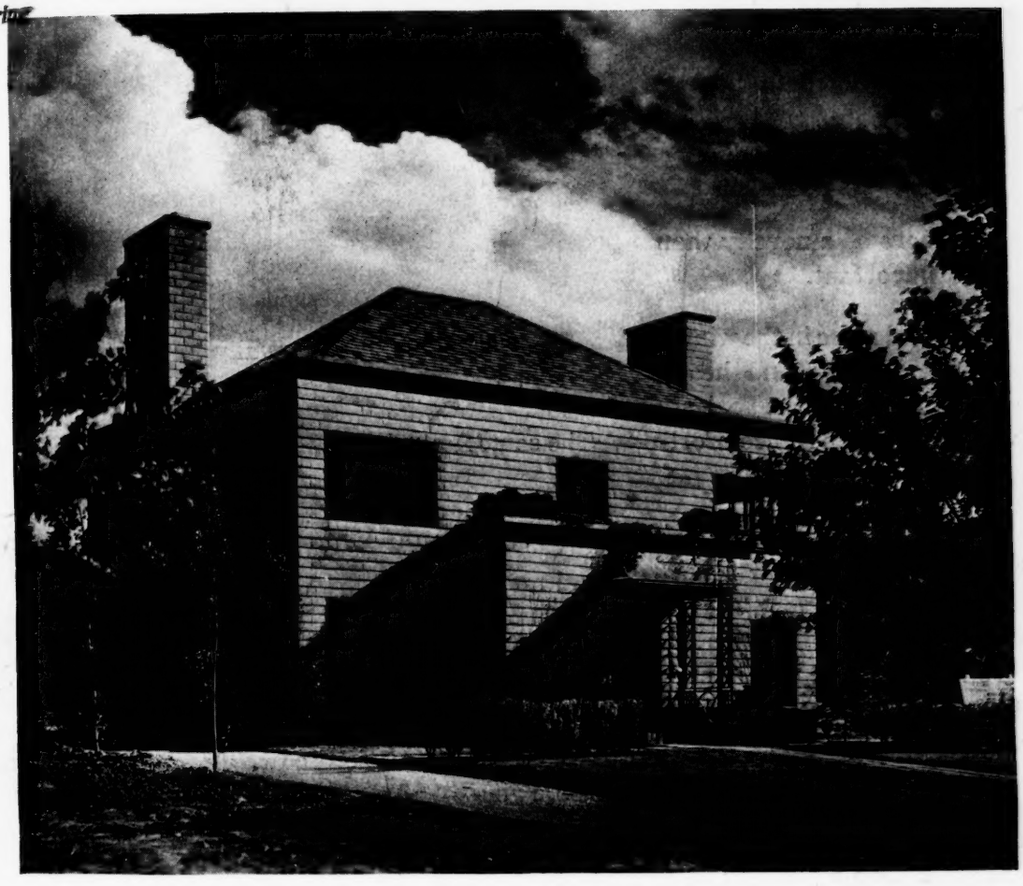
	New York	Boston	Pittsburgh	Chicago	St. Louis
Highest temperature, deg. F.	87	91	95	94	94
Date of highest temperature	8	26	31	30	10
Lowest temperature, deg. F.	62	59	50	58	59
Date of lowest temperature	13	24	20	20	19
Greatest daily range, deg. F.	22	26	31	26	28
Date of greatest daily range	20	25	1	29	6
Least daily range, deg. F.	5	9	13	3	8
Date of least daily range	7	19	28	12	13
Mean temperature for month, deg. F.	74.9	74.0	73.4	73.7	77.8
Normal mean temperature for month, deg. F.	73.1	69.9	72.9	71.6	77.5
Total precipitation, this month, inches	2.72	4.24	1.72	3.08	8.68
Total snowfall, this month, inches	None	None	None	None	None
Normal precipitation, this month, inches	4.33	3.62	3.23	3.21	2.99
Total wind movement, this month, miles	9013	4837	5661	6618	6622
Average hourly wind velocity, miles	12.1	6.5	7.6	8.9	8.9
Prevailing direction of wind	S.	S.W.	W.	S.W.	S.
Number of clear days	12	17	9	14	17
Number of partly cloudy days	14	10	14	10	10
Number of cloudy days	5	4	8	7	4
Number of days with precipitation	6	10	6	7	12
Number of days with snowfall	None	None	None	None	None
Snow on ground, at end of month	None	None	None	None	None

Plotted from records especially compiled for HEATING AND VENTILATING by the United States Weather Bureau.
Heavy lines indicate temperatures in degrees F. Light lines indicate wind in miles per hour.
Broken lines indicate humidity in percentage from readings at 8 a. m., 12 m., and 8 p. m. Arrows fly with prevailing directions of wind.
S—clear, PC—partly cloudy, C—cloudy, R—rain, Sn—snow.

Heating and Ventilating

NOV 7 - 1932

Engineering Library



NOVEMBER
1932

Factory fabrication methods made this house possible. Its frame is steel and the enamel surface finish is washable. Will production methods make this the house of the future? Story on page 39.